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48120 February 1994

MODEL AIRPLANE NEWS

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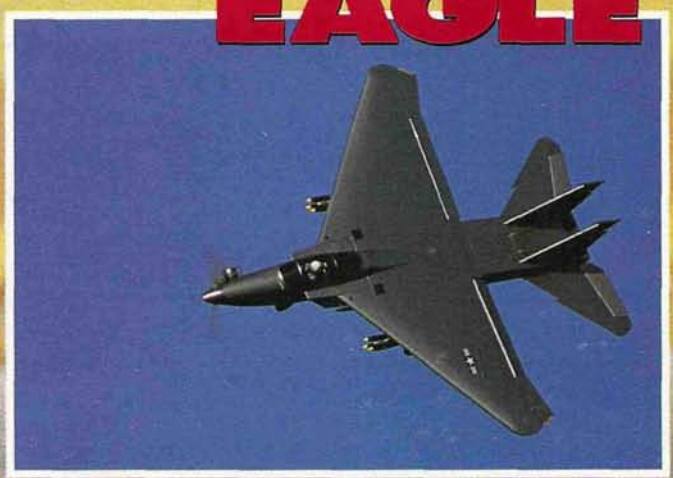

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FEBRUARY 1994 VOLUME 124, NUMBER 2

MODEL AIRPLANE NEWS

FEATURES

ABOVE: *on the flight line during an AT-6 heat race at the '93 Madera Unlimited Races. (Photo by Tom Atwood.)*

ON THE COVER: *center—John Lockwood's gorgeous 41-pound Saxton Mustang took first-place Bronze at the '93 Madera races. (Photo by Dan Parsons.) Inset: Great Planes' new F-15 Eagle slices up the sky. (Photo by Walter Sidas.)*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

Model Airplane News (ISSN 0026-7295) is published monthly by **Air Age, Inc.**, 251 Danbury Rd., Wilton, CT 06897. Second-class postage paid at Wilton, CT, and at additional mailing offices. Subscription rates are: $27.95 for 1 year (foreign, $37.95); $49.95 for 2 years (foreign $69.95). **Postmaster:** send Form 3597 to **Model Airplane News,** P.O. Box 428, Mount Morris, IL 61054.

EDITORIAL

TOM ATWOOD

THE GREAT R/C SLOW-FLIGHT DESIGN CONTEST

Co-sponsored by *MODEL AIRPLANE NEWS*, NASA Langley Research Center and the NACA Alumni Association

Would you like to win $1,000 for tinkering on your workbench and coming up with an innovative aircraft design? Would you like to contribute to the practical development of low-speed, controlled flight? Would you like to win a framed certificate, made out to your name and signed by famous NASA/NACA aviation pioneers? Would you like to become a famous modeler? You'll have a chance to achieve all this and more in the Great R/C Slow-Flight Design Contest co-sponsored by *Model Airplane New*, NASA Langley and the National Advisory Committee for Aeronautics (NACA) Alumni Association. We are announcing the general outlines of the contest here so that you can start dreaming up your design; more contest details will be available next issue. This is a year-long contest open to all, worldwide.

CASH PRIZES IN EACH OF THREE CLASSES!
1st Prize—$1,000
2nd Prize—$500
3rd Prize—$250

The purpose of the contest is to spur development of practical low-speed flight capability, i.e., to expand the performance envelope of traditional designs and come up with new ones. We wish to encourage the widest possible involvement in the competition, and to have a lot of fun along the way. We have developed two internal combustion classes and a third, indoor electric class. The winners, in addition to receiving a cash prize and award certificates signed by famous aviation personalities, will have their designs published in *Model Airplane News*. (Winners will be separately compensated for these articles.) All entrants retain all design rights.

The contest begins January 1, 1994. All entries must be received by December 31, 1994. Entries will be evaluated by a panel comprising NACA alumni and NASA design engineers. Winners will be chosen based upon performance and innovative design. Awards will be presented in early 1995 at the Virginia Air and Space Center in Hampton, VA.

BE PREPARED!

Entrants will need to provide a three-view, aircraft specifications (which will include a statement of performance), a description of the design (not to exceed two typed pages), still photos of the aircraft, a letter signed by a CD and local club president, and a videotape of flight tests. Winners must be prepared to submit a complete construction article (to include full-size plans, black-and-white construction photos, a discussion of the construction steps, and color slides of the model on the ground and airborne). Flight tests will be conducted locally by R/C clubs under the honor system and under applicable AMA safety guidelines.

•Internal combustion classes. All internal combustion entrants must have a displacement of between .40 and .50ci. The number of engines is optional. We wish to discourage the entry of conventional single- or double-rotor helicopters. Some fixed-wing area is required: the total swept area, (i.e., disk area) of propellers/rotors directing thrust downward cannot exceed 60 percent of the total of fixed wing (or lifting body) *and* said disk area. At least one prop must be able to function in a horizontal axis at least some of the time. No lighter-than-air gas is allowed. Planes must fly at a height of at least one wingspan. No other design constraints exist: large high-lift devices, thrust vectoring flaps, auxiliary fans, telescoping wings, tilt wings and powered glider/autogyro hybrids are all interesting possibilities. Previously published designs are excluded.

• Flight envelope, internal combustion. A point system that weights heavily in favor of slow flight but that also rewards total performance envelope will be used. It will allocate 20 points per mph under 30mph, and 2 points per mph above 30mph. If you can fly at 20 to 50mph, you'll get 240 points. If you can hover and fly up to 50mph, you'll get 640 points. In the Floater class, you'll gain points for high speed only if you can fly faster than 30mph.

Time trials will be held outdoors, with flight times the average of an upwind and downwind pass. Slow flight will be measured along a 100-foot strip that's no more than 20 feet wide (planes must stay within the strip). High-speed passes in the conventional class will be made along a 500-foot strip. Callers will time the passes or coordinate with a timer; radar guns may be used.

First-, 2nd- and 3rd-place prizes will be separately awarded in these classes:

• Internal Combustion Class A—"Floaters" Planes with a wing loading of 15 ounces per square foot or lower may compete in this class.

• Internal Combustion Class B—"Conventional Aircraft" This class more closely relates to the challenges faced by designers of conventional aircraft. It is open to aircraft with wing loadings of 20 or more ounces per square foot. The wing loading may be lower than this range with high-lift devices deployed.

• Indoor Electric. This is an unlimited class, but planes must be powered by electric motors running on commercially available Ni-Cd batteries. The use of off-the-shelf components is recommended. The plane must be able to fly at least two circuits around the perimeter of an indoor basketball court on one charge. It must be able to do a figure-8 within the court, although not necessarily on the same run as the laps. Slow flight will be measured along a 50-foot course that is 15 feet wide.

In all cases, a plane must be flight worthy after completing its record test run. If you have questions about the Great R/C Slow-Flight Design Contest, please forward them to Tom Atwood, 251 Danbury Rd., Wilton, CT 06897; fax (203) 762-9803, or send E-mail on the Internet to toma@airage.com. We hope this inspires you. ■

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News**, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ERRATA

In "Video Views" in our December '93 issue, the price of Telstar Video Productions' "Top Gun '93" video should have been listed as $29.99 plus $2.50 S&H (not $24.95 plus $3.25 S&H and 8 percent tax). We apologize for any inconvenience.

SABRE SEARCH

I just picked up a copy of your magazine and was really turned on by the "Top Gun" feature article. But I have a problem! On page 67, photo no. 8 appears to be an F-86 Sabre jet. The accompanying text says that it was built by Kent Nogy of Palos Robles, Templeton, CA. The text also states that this is a Bob Violett kit. I was particularly intrigued by the beautiful detail that went into this finished bird, and sought more information before going into a "buy" mode. Consequently, I fumbled through my '92 edition of the Buyers' Guide. Turning to page 72, I found that the F-86 Sabre jet sold by Jet Hangar Hobbies seems identical in finish to the jet owned by Kent. *Model Airplane News* states that Kent's jet has a 58-inch wingspan. The Jet Hangar's kit has a 40- to 44-inch-span. Which kit should I buy to build a model similar to Kent Nogy's masterpiece?

BUZZ BORDEN
Hopkinton, MA

Buzz, you could build either kit and dress it up like Kent Nogy's. Kent's F-86 Sabre jet is indeed from a BVM kit as reported in the September '93 "Top Gun" article. Kent did a beautiful job duplicating the finish of the full-size aircraft. The markings for Kent's F-86 are available from Aeroloft Designs, 2940 W. Gregg Dr., Chandler, AZ 85224; (602) 838-0447. Aeroloft produces high-quality, handmade dry transfer markings that are custom-made to your specifications. In many instances, Aeroloft includes popular designs and color schemes for particular aircraft in their catalogue. The markings on Kent Nogy's F-86 "Skyblazers" are from one of the sets in that catalogue.
GY

YAW-PITCH COUPLING QUESTION

A pattern-ship designer/flier from Texas has an unusual problem. When he yaws his airplane with rudder, its nose drops. When the plane is inverted and yawed, its nose rises.

A friend demonstrated this behavior while flying a Great Planes Ultra-Sport 40 with retracts and no dihedral. In level flight, upright and yawed by rudder, the nose pitched down rather sharply. In yawed, inverted, level flight, the nose pitched up equally sharply. This is yaw-pitch coupling.

He tried the same maneuvers with the Swift (*Model Airplane News*, September '93), but there was no evidence of yaw-pitch coupling. Instead, owing to the Swift's 3-degree dihedral, a fast spiral dive ensued; this was yaw-roll coupling of the type that occurs on rudder- and elevator-only models—with their pronounced dihedral—as the rudder is employed.

Later, similar trials were conducted using a full-scale Piper Tomahawk. This airplane is a tricycle-geared, low-wing, two-place trainer with a large bubble canopy and a T-tail. Pulsing the rudder from side to side in level flight made the airplane yaw from side to side, but there was no nose drop. Applying rudder and holding it resulted in a spiral dive. Yaw-roll coupling occurred owing to this airplane's dihedral of about 7 degrees.

A side-slip, with the engine throttled, is a maneuver in which the airplane is banked one way with aileron, and heavy opposite rudder is applied. The plane doesn't turn, but slides sideways;

the fuselage side, exposed to the oncoming air, greatly increases the plane's drag and the sink rate. This maneuver was used before the introduction of flaps to provide a steep, slow, controlled landing approach. Side-slipping the Tomahawk was uneventful. Fortunately, there was no yaw-pitch coupling; a sudden nose-down pitch at low altitude isn't healthy.

My conclusion is that, when yawed, pattern ships—such as the Ultra-Sport 40—with deep fuselages for good knife-edge performance experience a fuselage-caused turbulence that increases the horizontal tail's lift, and this causes nose-down pitch (or nose-up, when inverted).

This letter has been written with the hope that others have experienced this yaw-pitch coupling and may have found a cure. Readers' comments are invited.

A.G. LENNON

HB BOUNTY

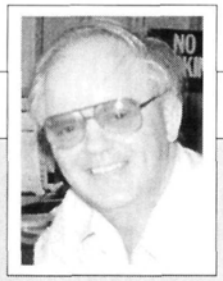
I've been a follower of *Model Airplane News* for years. To prove how long: do you remember an article on "Fly Power" at a meet in Sacramento CA? That was before air-conditioning in hotels. Anyway, I'm writing to see if you know where I can get HB parts or engines repaired. I wrote to the company and the mail was returned.

MERLE LEONARD
Eastman, GA

Merle, you're in luck. RJL Industries, 1831 Business Center Dr., Duarte, CA 91010; (818) 359-0016, has almost all of the parts for the HB engine line. We called and found out that they have just about every part for the .12, .15, .25, .40, .50 and .61 PDP engines. RJL has been slowly adding to their line of old engine tooling, and they travel around the world in their quest for these parts. They have the entire HP line, including the .21 and .49 4-strokes, the Forster .29, .35 and .99 old-timer engines (reproduced from the original molds) and the Cox Conquest .15 engine. Give 'em a call. GY

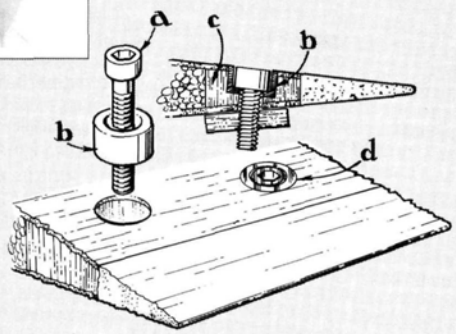
(Continued on page 138)

HINTS & KINKS



JIM NEWMAN

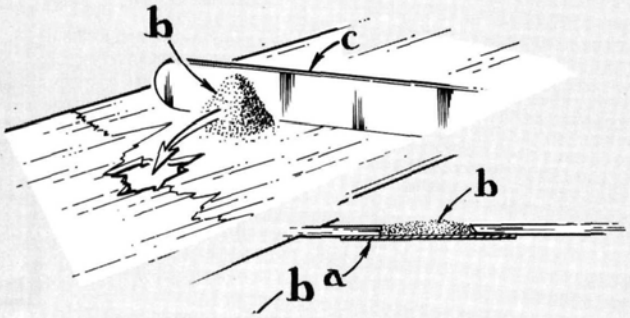
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



FLUSH WING BOLTS

On a scale model, flush bolt heads are easier to disguise. Using a lathe, turn down the head of each nylon wing bolt to remove the "hex" (a), and machine "cups" (b) out of nylon or ABS plastic. Run each bolt through a cup, and glue each cup into the trailing-edge block (c) so that the cup and bolt are flush with the wing's surface (d). If you don't have a lathe, round the bolt heads using a file, and find suitable cups at a hardware store.

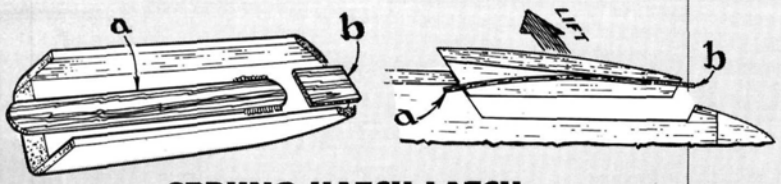
Hans Heck, Stirling, Australia



HIGH-STRENGTH FILLER

After you've carefully mended a broken model, you may still have gaps. To fill them, glue a thin scab of balsa (a) to the back of the piece to cover the hole, then brush balsa dust (b) into the hole and pat it down using a blade (c). Drip some thin CA into the balsa dust, and you'll have a strong filler that can be sanded. The filler can also be used to make reinforcing fillets around joints.

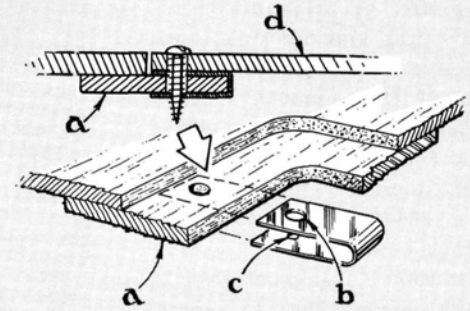
Niels Ingerslev, Hong Kong



SPRUNG HATCH LATCH

Glue a Popsicle stick or a strip of birch plywood (a) to the inside of the hatch, attaching it only at the front. The front end of the hatch is secured by the usual tongue (b) that engages the underside of the nose sheeting. The secret to removing the hatch is its sloping rear face that allows you to slide it rearward and upward to spring the Popsicle stick. When the stick is clear of the opening, you can pull the hatch off.

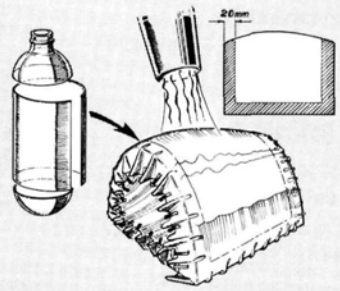
Larry Renger, Cerritos, CA



NON-STRIPPING HATCH SCREWS

Frequently, removing hatch screws quickly wears down the threads in the balsa or plywood. To avoid this, bend a piece of brass strip to fit around the lip of the hatch opening (a). Drill a clearance-size hole (b) in the top of the strip and a tapping-size hole (c) in the bottom. Then slip the strip over the lip, and secure it with a little CA. The hatch (d) shown is recessed, but this will also work with hatches that lie flat on the surface.

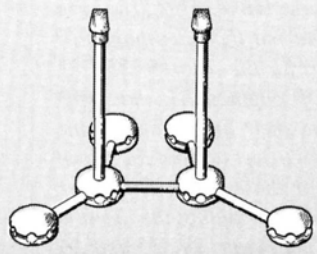
Scott Dismukes, Allen, TX



DRAPE-FORMING CANOPIES

Cut off the top and bottom of a plastic soft-drink bottle, and cut the center section to form a flat sheet of plastic. Wrap the flat plastic tightly around a wooden, plaster, or epoxy-finished foam mold, and staple it in place. The plastic should be 3/4 inch larger all around than the part needed so that you can trim it later. Don't slit the material, and don't worry about creases or folds; the material has a high-shrink rate. Using a powerful hair dryer or a hot-air gun, heat the material until it shrinks tightly around the mold. You can also use this molding technique for cowls and fairings.

John Holcroft, Picton, S. Island, New Zealand

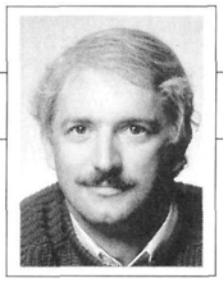


TINKERTOY BALANCING JIG

This jig for determining the balance point of a new model is made of Tinkertoy parts. And if you have young children who have the toy, it won't cost you a cent!

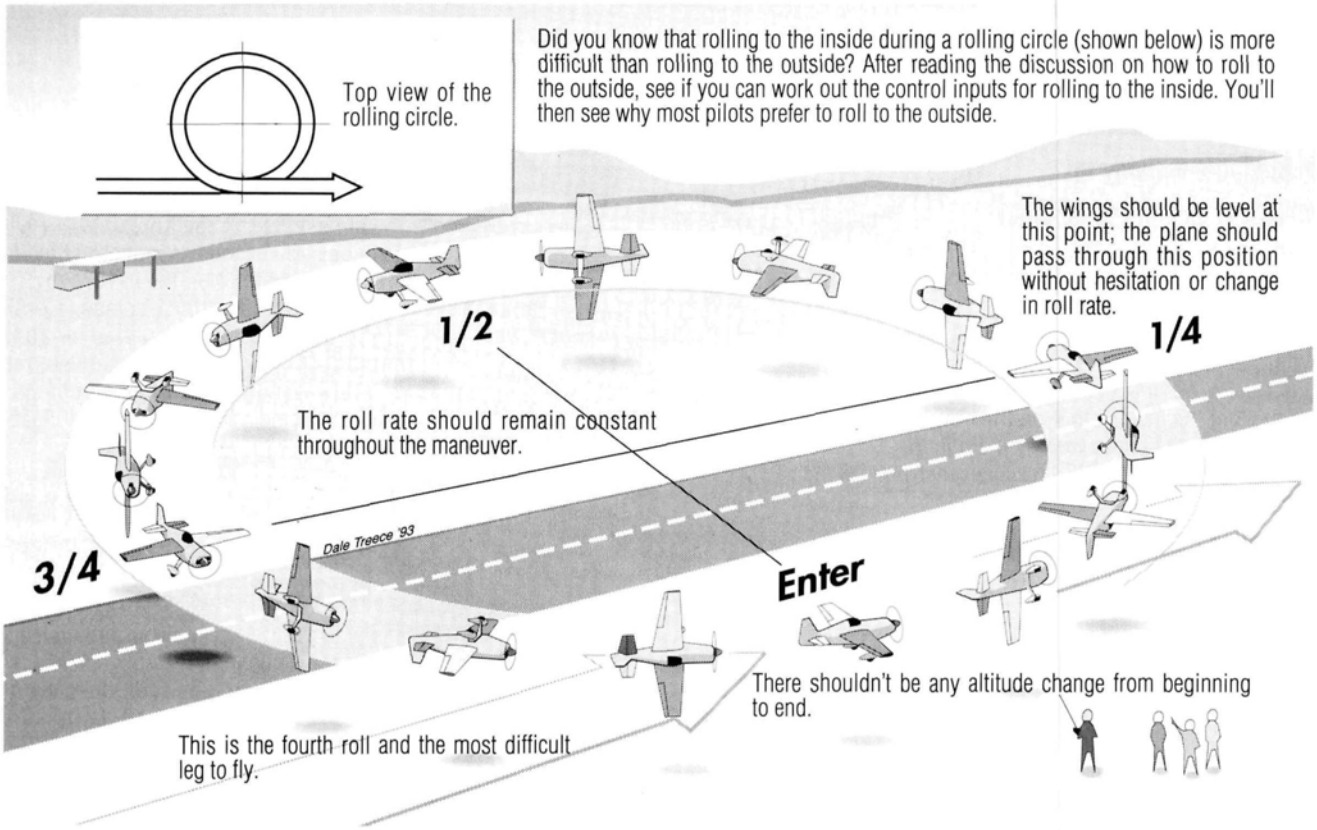
Jim Williams, Trotwood, OH

AEROBATICS MADE EASY



DAVE PATRICK

THE ROLLING CIRCLE



In full-size aerobatic competition (IAC) and in TOC and IMAC competition, contestants don't compensate for wind when they perform a rolling circle. To compensate for wind, you must change the roll rate. In a situation like that illustrated in the diagram above, if the wind is coming from the right, a slower roll rate would be needed in the first and fourth quadrants to enable the plane to finish at the same position relative to the ground. The second and third quadrants would require a faster roll rate. By ignoring the wind, the roll rate and heading changes can remain uniform, but the plane won't exit the maneuver in the same location (relative to the ground) that it entered. I find that, with a little wind, a little compensation will result in a more pleasing maneuver.

A PROPERLY performed rolling circle can be a sight to behold. To most of us, mastering this maneuver just doesn't seem possible! It is, of course, extremely difficult to do successfully. This month, for those who aspire to perform this maneuver, I'll go through the basics and offer a few pointers.

THE MANEUVER

A rolling circle *isn't* a large, 360-degree turn with many rolls, in which the pilot uses elevator to turn or to change heading. A true rolling circle is a 360-degree turn with a specific number of rolls, usually one, two, three, or four. Because there are few rolls, they are, in fact, *slow rolls,* and that's where the high level of difficulty comes in. To perform a four-turn rolling circle, you must execute four continuous rolls while maintaining a constant heading change, and each roll must be completed at every 90 degrees of heading change.

THE PLANE

You'll need a highly aerobatic aircraft with a particularly effective rudder. Some pattern ships will do, but many won't because they weren't designed to perform this kind of maneuver. For example, the Conquest series would have a tough time, but the Finesse 1.20 would do this maneuver acceptably. Scale aerobatic aircraft, such as the new series from CGM*, e.g., the Ultimate, the Extra and the new Sukoi, perform these maneuvers really well. There are many other good designs that would do well, but because I designed the CGM series, I'm very familiar with their flight characteristics and in a better position to comment on them.

How your plane responds to rudder will determine whether it's a good

candidate for a rolling circle. The plane should be able to sustain knife-edge, but the ability to climb in knife-edge would be even better. There should be no pitching or rolling when rudder is used in knife-edge; coupling of pitching or rolling with rudder input makes it much more difficult to perform the rolling circle properly.

BIT BY BIT

Because this maneuver is so complex, don't try to do it all at once. For our working example, let's take the four-turn, to-the-outside, from-upright, starting-left-to-right, rolling circle (whew!). Got it? Starting from your left, do four continuous slow rolls, rolling right. There will be a 90-degree heading change, counterclockwise, for each completed slow roll. Got it now?

Focus on getting through the first slow roll with a 90-degree heading change. (I'm assuming, of course, that you're pretty good at slow rolls; for more on that topic, see my column in the December '93 issue.)

HERE WE GO

As you start rolling slowly to the right, apply "top" (left) rudder earlier than you would for a typical slow roll. Before the plane arrives at a knife-edge attitude, this top rudder will start the heading change *and* keep your altitude. As you approach the knife-edge position, apply a small amount of down-elevator to continue the heading change. Simultaneously, as you pass the knife-edge position, slowly remove the top rudder so that when the plane is inverted, all left rudder is gone; then start to apply right rudder. As you rotate past knife-edge, you'll have to reduce down-elevator so that, by the time the plane is inverted, you have only enough to sustain inverted flight. Also, don't remove that down-elevator input too fast because this provides your heading change.

Now, as you pass inverted, you must apply right rudder; this will continue the heading and maintain altitude. At the same time, start to apply up-elevator to provide heading change again and to maintain altitude as you pass through the next knife-edge position. When the plane is upright, you'll have completed one slow roll with a 90-degree heading change. This is easier said than done, especially when you're constantly mixing the proportions as you roll and change heading!

When you're comfortable with one roll (and this may take quite a few flights) proceed to two rolls and so on. You'll quickly find that the most difficult part will be the last roll. That last quadrant (see diagram) presents you with a very unusual situation: trying to do a slow roll with a heading that comes at you! I can offer you no help other than to tell you to give yourself comfortable altitude and practice. If you build your rolling-circle skills bit by bit, you'll find that this helps you gain the proficiency to work out the last roll.

VARIATIONS

I've been focusing on a particular version of the rolling circle; here are a couple of variations: how about a four-turn roll, as before, but alternate the direction of rotation and start from inverted? (This maneuver was in the last TOC.) Or, try a two-roll, rolling circle, or a single roll.

TOO MUCH POWER

Most people use full power during their rolling circles, but a few pilots have discovered that by using a lower power setting, they can perform a maneuver that isn't quite so large, and they have more time to think. If you can set up your radio so that the

(Continued on page 101)

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Left: Rob Roy. Above, left to right: Chris Justice, pilot; Greg Poppel, flight team manager; Tony Husack, pilot.

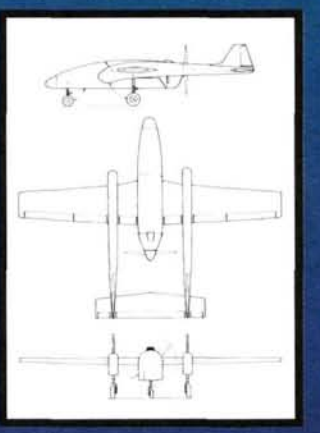
R/C Opens the Door

There are some great things happening in the R/C industry—stories of inspiration and achievement—that don't always get told, or that sometimes can't be publicized because of their confidential nature. Rob and Lisette Roy of L&R Aircraft—a developer of airframes for what are commonly referred to as remotely piloted vehicles (RPVs) or unmanned aerial vehicles (UAVs)—are primary figures behind one of these stories. Rob is the designer and shop manager, and Lisette is the general manager and owner. Enough is now publicly known about L&R's successes to unveil some of the accomplishments of this woman-owned business.

Rob's Airtrax designs have been favorably reviewed in these pages and elsewhere (Dave Gierke uses Airtrax aircraft to test-fly engine/prop combinations in his "Real Performance Measurement" column). Two years ago, Rob became interested in the growing (some say exploding) market for UAV designs. He obtained copies of government agency reports predicting the emergence of a several-hundred-million-dollar market for UAV aircraft. Rob, with Lisette's support, set his nose to the grindstone and entered the world of competitive bidding for UAV designs. In the last 18 months, L&R has been propelled to the forefront of the rapidly growing military and commercial UAV market. The effort was entirely funded (and still is) by the modest profits from L&R's commercial R/C business.

HBR3/B

Rob proudly notes that more than one of his designs are now "in procurement" (the first stages of a somewhat protracted government purchase). His larger UAV design "carries up to its own weight in payload, tracks through the air tenaciously despite the extra weight and is very user-friendly." Built on a budget and in a hurry, this aircraft beat out some more established, far more expensive designs.



His larger series of sport R/C aircraft, the Q-series, is now used in UAV pilot training programs. Shown here are an artist's rendition of a large UAV design (and a three-view) and photos of a prototype S-series UAV designed for law enforcement (disassembled, it can fit in the back of a patrol car). The smaller plane has been test flown with an Enya 1.20 pump engine running backward. His winning designs have borrowed design nuances from both the pattern and pylon racing arenas. L&R UAVs use aerodynamic boost tabs. (For more on these devices, see Carl Risteen's articles "Labor Saving Devices for Overworked Servos" in the September and October '93 issues.)

Rob notes that the R/C industry "no longer needs to take a backseat" and believes that the ultimate success of his designs will be a win-win situation for L&R and the industry as a whole. If L&R succeeds in selling a good deal of products to government agencies, the profits will help L&R develop additional products for the R/C market. It will be a victory not only for one indefatigable designer, his manager and those who have supported the shoestring effort, but also for the R/C market as a whole. Rob notes his key goal is to integrate R/C technology into the expanding commercial UAV marketplace. L&R's challenges are only beginning. Although inquiries in negotiation could result in hundreds of thousands of dollars of revenue, the procurement process is protracted, and L&R continues to maintain its effort based on R/C sales and sheer grit. We wish L&R full success in this effort, and we'll keep you posted. Call..(217) 834-1578

NEW

AIR SCOOP

SORIANO & SUKHOI

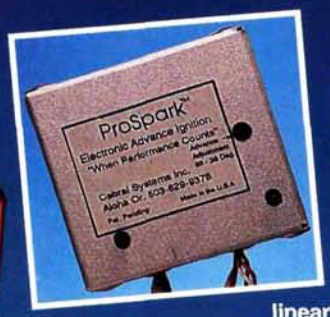
Here are two that everyone falls in love with—*Model Airplane News'* beautiful managing editor, Julie Soriano, and the Russian Sukhoi. This sleek, new, .30-size ARF version of that famous and beautiful SU-26m is brought to us by EZ Sports Aviation. The 50-inch-span Sukhoi weighs in at 56 to 63 ounces and has 446 square inches of area. Power requirements are a .25 to .36 2-stroke (the Magnum .36 reviewed by "Dyno-Dave" Gierke in this month's "RPM" should make this thing go straight up), or a .48 to .53 4-stroke. The airfoil is semisymmetrical for good slow-flight characteristics, and advanced manufacturing techniques have made the top *and* the bottom of the fuselage round. Those EZ guys just keep making them nicer and nicer.

Cox Throttle Is Here!

It's now official. The Cox competition .051 and .09 Tee Dee engines are being fitted with true carburation. Machined of bar stock, these new carbs are air-bleed types, much like the ones Enya has successfully used for so many years. Of course, the non-throttle Tee Dees will remain available. Mufflers are included. We'll have a closer look as soon as we get some production samples.

Right In-Between

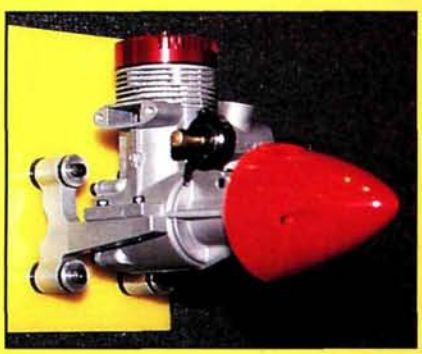
It's no secret—the Zenoah G-38 and G-62 are all-time favor-ites of the giant-scale modeler. Well, here's an all-new G-45 from ISC. Place your orders early; this one is going to fly (no pun intended) off the shelves!



GLOW PLUGS, WATCH OUT!

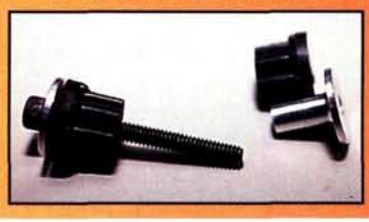
ProSpark is an electronic ignition for glow or gas engines that replaces your glow plug with a small spark plug. The user-controlled electronic advance ranges from 22 to 38 degrees at the top end. On installation, the unit fires the spark plug at top dead center (TDC), and from this point firing can be advanced linearly by adjusting a small potentiometer.

At the Madera races, ProSpark ran a SuperTigre .61 ringed engine—no mods—on unleaded gas with the device. With an 11x8 APC it had a top end of 12,300rpm and an idle of 2,000rpm (think of the fuel savings). A Webra 4.4 unlimited racing engine equipped with a racing prop gained an additional 1,000rpm (to 8,400rpm) on 8 percent nitro (versus 25 percent nitro and three glow plugs without ProSpark) and was able to reliably idle at below 1,000rpm. ProSpark is different from other ignition systems because it allows the user to electronically advance the spark without rearranging any mechanical gear installed on the engine. For information, contact Duarte Cabral at Cabral Systems at (503) 629-9378.



Catch the Vibe

According to Du-Bro designer Bill Sterka, these new isolating motor mounts are the most advanced ever designed in dealing with harmonic vibration. The secret lies in a totally captivated mount that can't debond and break free. They are touted to be very effective in reducing vibration and fatigue on airframes and all delicate internal components, such as receivers and servos. They're easy to install using four blind nuts that don't protrude past the back of the firewall—thereby not intruding into the fuel-tank area.



The Future is Beaming Down

Inquisitive R/Cers who want the full story on plane, engine and propeller performance now have yet another down-link telemetry product—this one, from Aero Telemetry—to consider. (By the time this trend plays out, will we have interactive wristwatches for communicating with our planes?) This new unit is an adaptation of a sophisticated device that was developed for full-scale Reno racers and NASCAR racers. It comes in two versions:

- The 3-channel system (receiver is shown on the middle of the photo) indicates battery voltage, engine rpm and air speed on an LCD display.
- The 6-channel system adds a two-engine rpm option, optional altimeter, exhaust-gas temperature, cylinder-head temperature and IBM download capacity. That's right! You can plug it into your laptop and review your flights later that day on your PC. The 4.5-ounce onboard unit is shown held. For more information, call Aero Telemetry at (213) 746-9380, or (800) 746-9380; fax (213) 746-7296.

TECATE
(ta cat' ee)

Global Hobby president Paul Bender was kind enough to take a few minutes out of his busy schedule to pose with the all-balsa, 40-size Tecate—one of the many new kits in the Global line. With its swept leading edges and rakish turtle deck, the Tecate is a unique, racy-looking bipe. It has a 50-inch top wing, a 44-inch bottom and a combined area of 690 square inches. The Tecate will be available in the early summer of '94.

Hassle-Free Hornet

In an earlier "Scoop," I published a picture of this G&P Sales F-18 design in unfinished form. After viewing a video on the flight performance, I was so blown away by the Hornet that I just had to talk about it some more. Although this 60-inch-long F-18 does jet-like victory rolls and low passes, it slows to a crawl and does nose-high, carrier-style spot landings that are a sight to behold. Plus, if you're the type who is put off by ducted-fan complexity or who winces at the thought of crankpins spinning at 24,000rpm, then take a close look at this Hornet. The pusher .61 is hidden in the "turkey feathers," so in flight, it's difficult to tell if it's a ducted fan or not. The superior acceleration of the prop drive is the only giveaway. If you prefer a tuned pipe, you can run one inside the fuselage and exit the exhaust through the bottom of the fuselage (dumping the messy oil out the bottom). A very neat setup indeed; you'll be hearing more about this one. For more info, contact G&P Sales, 410 College Ave., Angwin, CA 94508; (707) 965-3866.

Two ARF Stars

Futaba's Richard Verano is holding the new Futaba Haig Superstar. This colorful new addition to the Futaba line of ARFs has a 63-inch wingspan that packs 665 square inches of area and weighs in at 7.75 to 8.75 pounds. Power requirements are a .60 2-stroke or a .91 4-stroke. The new Futaba YS 4-stroke air chamber would be ideal for tremendous constant-speed aerobatic performance. I'll have a picture of this new engine in the next "Scoop." Incidentally, Richard "ARF" (Always Ready to Fly) Verano recently went to Nötsch, Austria, and returned as the 1993 F3D Pylon World Champion—a star in his own right. Nice airplane...nice guy.

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1994. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

'50s DC-3

Chester H. Babbin of Goldens Bridge, NY, built this DC-3 from a Royal C-47 kit. Done up in Eastern Airlines dress from the '50s, this eye-catching passenger plane has an 83.5-inch wingspan and is powered by two SuperTigre .51s spinning 10x6 props. The nacelles contain 10-ounce tanks, so no fuel pumps are needed. All the decals are original. An Aerogloss finish and a coat of polyurethane keep this bird shining. Since submitting this picture, Chester has mounted pictures of his Westchester Miniature Model Aircraft Club flying buddies in the passenger windows.

NOW YOU SEE IT...

Not all pilot projects display impressive longevity, but that doesn't mean their stories shouldn't be told! Vincent Filbiche of Belgium sent us this photo of his ½-size, precision-scale Bumble Bee, which took more than four months to build. The 28-pound, all-wood model had a 1-meter wingspan and was powered by a King 60cc, 7hp engine. There were "no vicious tendencies" during the first and last roll-outs. The plane took off with "great stability in all axes." Then the throttle was opened up, and suddenly, the model climbed vertically and stalled. It "finished on the ground with a big noise of broken wood." Don't feel too bad, Vince; most of us have been there!

THE LEGEND LIVES!

Gunther Schniggenfittig, of the Luftsportclub 63 Büdingen, Germany, scratch-built this beautiful 24-pound, ⅓-scale Fokker triplane—the one flown by the famous Red Baron—from an old plan and using a special book from Fokker. The Solartex-covered plane has a wingspan of 85.8 inches and is powered by a Zenoah G-62 spinning a 24x8 propeller. Two servos control the wings, two control the elevator, and two control the throttle and rudder. Gunther—a retired "Maschinenbauer Meister" and a modeler for 44 years—uses a Multiplex 3030 PCM radio to fly this beauty.

BIG JUNIOR

Thomas J. Ryan, SAM no. 2541, scaled up this Playboy Jr. from 54 to 87 inches. The customized SuperTigre .40 RR-powered, Solartex-covered model has an even higher aspect ratio than the original, and this promotes trusty, slow flight. We think it might fly slowly enough to land in snow without skis. Is that right, Tom?

PILOT PROJECTS

P-38 SLOPER

Daniel Fulmer of San Francisco, CA, scratch-built this scale sloper of a P-38 Lightning, and it's no wonder: his wife's mother (who riveted P-38s) and father worked for Lockheed during WW II. For better performance on the slopes, Daniel fattened the tip chords, increased the aspect ratio of the main wing, thinned the booms and lengthened the pilot pod. The wings are made of foam, and the engine and pilot pod are made of glass-covered foam (200 hours of building went into the plane). The 7½-pound sloper has a wing area of 1,000 square inches and a span of 103 inches. Daniel has test-flown the ship in light winds, but he's waiting for a stronger lift to really take its measure.

EAA 1/4-SCALER

Norm Henderson of Modesto, CA, built this EAA ¼-scale bipe from a Balsa USA kit. He covered it with Aerospan (Cessna White) and dressed it with markings that were "lying around the shop. (After more than 40 years of model building, there's a lot lying around.)" It's powered by an O.S. Max 90FSR that spins a 15x6 prop; this gives it "vertical performance a Pitts would envy." Nice job, Norm.

SUPER STEARMAN SHOWSTOPPER

Jack Strickland of Carrollton, TX, scratch-built this Sachs-Dolmar 5.8-powered, ¼-scale Super Stearman, and he has flown it and impressed the crowds at a number of giant-scale events. This photo (by Dan Parsons) was taken at the Big Bird Fly-In put on by the Lufkin, TX, club last year. Jack honed his flying skills as a top pattern pilot in the '60s.

GALLOPING GLIDER

Rick Vaccarella of Virginia Beach, VA, designed and built the Pegasus—a 120-inch-wingspan glider that has a light wing loading of only 4.2 ounces per square foot. Pilot friend Todd Jeffrey is seen in the photo. The 5-foot fuselage uses a light truss design, and the wings are turbulated. Its grace and beauty in the air are said to live up to its mythical namesake!

"DOUBLE TROUBLE"

No wonder Dick Cardillo's (Pompano Beach, FL) Double Trouble didn't fit into the picture: it's a composite of two giant Lanier Stingers! Two 30cc custom-converted chainsaw engines yank this 31-pound craft through the air. Of course, an R/C stunter this large requires two attentive pilots with quick reflexes (see cockpit). This Ultracote-covered model has a span of 116 inches. Send us a knife-edge shot with smoke! ■

MODEL AIRPLANE CONSTRUCTION NEWS MAGAZINE

by CHUCK RHODES

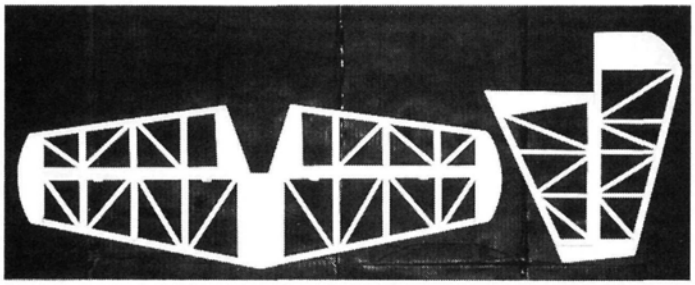
ALTHOUGH BIPLANES aren't for everyone, biplane lovers should thoroughly enjoy building and flying this highly aerobatic "sport bipe." This all-balsa-and-ply model (no foam) is light for its size, and it's capable of all the inside and outside maneuvers that are flown by pilots of full-scale aerobatic planes.

The CR-270 bipe is actually the offspring of an earlier design of mine—the CR-170 monoplane. Because the planes' fuselages are similar in their outward appearance, when you order a fiberglass cowl and pants for the CR-270 from Fiberglass Specialties, ask for the CR-170 parts. The CR-270 bipe uses the CR-1760 canopy, which is also available from Fiberglass Specialties. Formed-aluminum landing gear can be obtained from the author*.*

CR-270

An IMAA-legal sport biplane with unlimited performance

The CR-270 was designed around the SuperTigre* 2500, and the engine fits nicely inside the cowl. I mount the engine inverted with the cylinder head to the right-hand corner of the firewall. For the sake of appearance (less butchering on the cowl), I find that this method of engine mounting works best. The cowl needs only a small oval cutout just above the scoop to clear the exhaust pipes of the Bennett* muffler. Another small hole is cut for the glow plug connector, and a Du-Bro* Kwik Fueler is mounted in the side of the fuselage just behind the cowl.



The completed horizontal and vertical tail parts are all made of 3/8-inch-square and 1/4x3/8-inch balsa.

The building sequence is left to the builder. No single part of the plane is needed before another, so build the way you normally do, and have fun.

The CR-270 is all framed up and ready for covering. The wheel pants, the canopy and the engine cowl are available from Fiberglass Specialties, and the aluminum landing gear can be obtained from the author.

FUSELAGE

Construction of the fuselage may present a small problem to some builders. Construction is what I call a continuous taper or wedge. The fuselage continuously tapers from the firewall to the tail post. Gluing the formers to the fuselage side at a 90-degree angle throws everything out of kilter when the fuselage sides are joined.

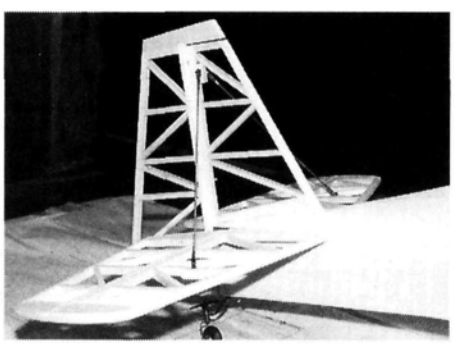
To help solve this problem, mark the positions of all the formers on both the right and the left fuselage sides. Make sure that the 1/4-inch-square stringers and the fuselage doublers have been glued to the fuselage sides.

Glue the firewall and F-7 to the right fuselage side. When the glue has dried, glue the left fuselage side to the firewall and F-7. Turn the fuselage upside-down and slip the remaining formers in place. Hold the formers in place with no. 64 rubber bands. Align the fuselage over the top-view plan, and glue all the formers into place.

When the fuselage sides have been joined, you can glue the following into place: the landing-gear plate, the wing hold-down blocks, the triangle stock and the balsa sheeting from the trailing edge of the wing saddle back to the plywood tail-wheel plate. Before gluing the tail-wheel plate, make sure that you have drilled the holes and inserted blind nuts, if you use C.B. Associates* or similar gear.

This side view of the basic fuselage structure shows the simplicity of the construction. The sheeting, the hatch and the turtle deck have yet to be installed.

All the turtle-deck formers, the hatch formers, the cabane blocks and the 1/4-inch-square balsa stringers can now be glued into place. Also, glue on the remainder of the fuselage sheeting. When it has completely dried, cut out the cockpit opening and sand the entire fuselage smooth.



The built-up tail parts require wire reinforcement. Threaded 2-56 wire and clevises work well and make the setup adjustable.

TAIL SURFACES

The tail sections are built directly over the plans out of 3/8-inch-square and 1/4x3/8-inch balsa. Functional flying wires shouldn't be omitted from the tail area. Be sure to add the 3/8-inch hardwood blocks to act as hard attachment points.

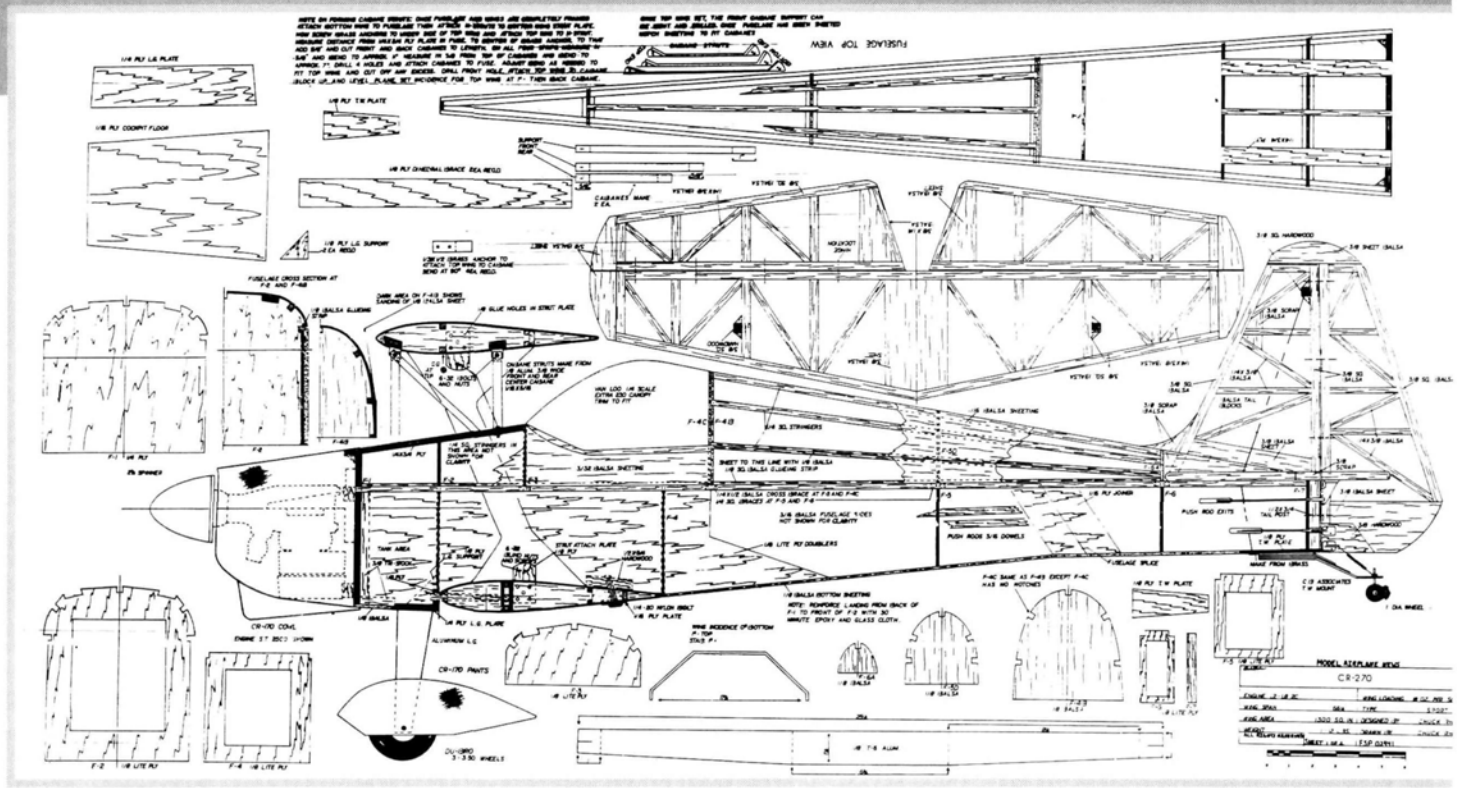
WINGS

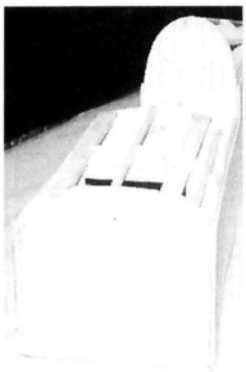
The wings are built on shims, and the plans show their positions. When the shims are in place, the wings are built in the usual

MATERIALS LIST

3/16x6x36 balsa (3)
3/8x4x36 balsa (1)
3/32x6x36 balsa (1) for hatch
1/16x4x36 balsa sheeting (8)
1/16x3x36 balsa sheeting (16)
3/32x3x36 balsa sheeting (6) for ribs
3/32x4x36 balsa sheeting (1) for lower wingtips
3/32x6x36 balsa sheeting (1) for top wingtips
1/8x6x36 balsa sheeting (1) for turtle-deck formers
1/8x3x36 balsa sheeting (2) for fuselage bottom/sides
3/8x36 triangle stock
14x36 square balsa (16)
3/16x36 square balsa (9)
3/8x36 square balsa (8)
1/4x3/8x36 balsa (5)
3/8x3/4x36 balsa (4) for leading edge
1/4x3/4x36 balsa (3) for trailing edge at aileron and center trailing edge at top wing
3/8x3/4x12 maple (2) for top wing
1/2x3/4x12 maple (1) for wing hold-down blocks
1/8x12x36 lite-ply (1) for formers and fuselage doublers
1/16x6x12 plywood (1) for cockpit floor
1/8x12x36 plywood (1) for dihedral braces, tail-wheel plate, N-struts, N-strut attachment plates and landing-gear supports
1/4x12x16 plywood (1) for firewall landing-gear plate cabana plates
3/8x36 square spruce (1) for servo rail flying wire attachments
1x2x36 balsa block (1) for tail blocks and filler in wing area
1/2x3/4x36 balsa (1) for tail post and cross-braces in fuselage at F-3 and F-4C
1/16x3 1/2x12 plywood (1) for joiner at fuselage splice

All dimensions are in inches.





The aluminum cabane struts are attached to hardwood blocks that have been installed in the forward fuselage.

fashion. Set all the ribs on the main spar—90 degrees to the work surface—and glue them into place. Add the top main spar and the ¼-inch sub-spar. Glue on the wing leading edge and the 1/16-inch vertical webbing.

Unpin the wing from the board, turn it over and pin it back into place. At this time, glue on the 1/16-inch balsa leading and trailing-edge sheeting and the bottom sub-spar. Unpin the wing from the board and turn it right-side up again. Glue the filler blocks into place in the leading edge of the wing. The trailing-edge filler blocks can also be glued into place. When the bottom wing panels have been built, cut slots in the center section ribs and glue the dihedral braces into the right wing panel. When the glue has dried, glue the left panel to the right panel.

Add the top leading edge and trailing edge sheeting, the top and the bottom center-section sheeting and the ⅜x¾-inch balsa cap to the trailing edge of the wing in the aileron area. When the balsa cap has dried, sand it to an airfoil shape.

Both the top and the bottom wings are built flat; there's no dihedral. If it's possible and you have enough room, the two wings should be built as a complete unit and not as separate panels.

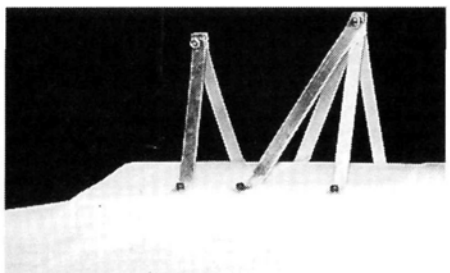
SPECIFICATIONS

Type of aircraft: Sport biplane
Wingspan: 66.5 in. (both wings)
Total wing area: 1,320 sq. in. (approx.)
Airfoil: Symmetrical
Dihedral: None
Length: 53.5 in.
Rec. engine: 1.08 to 1.8 2-stroke; 1.2 to 1.6 4-stroke
No. of channels req'd: 4 with 6 servos (rudder, elevator, throttle, aileron)
Engine used: SuperTigre 2500
Prop used: 18x6

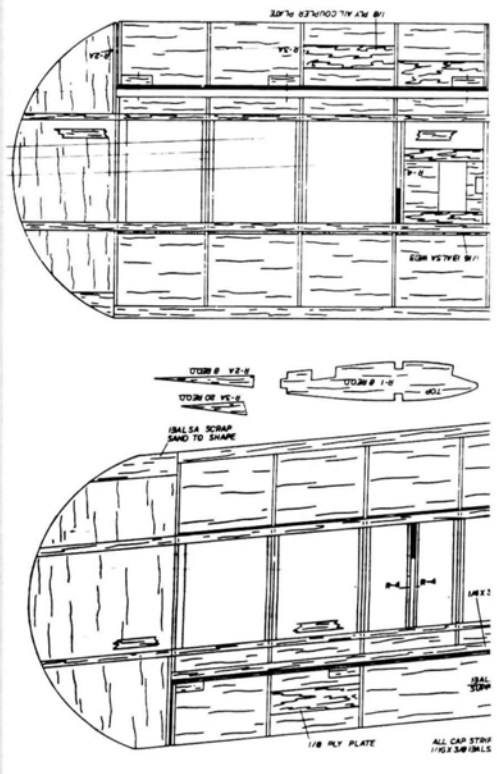
Other than the sweep in the top wing and the maple blocks that house the 90-degree brackets for the cabanes, the top wing is built in the same manner as the bottom wing. Notice that the hardwood blocks in the top wing aren't flush with the ribs in the cutout. This allows the 1/16-inch balsa sheeting to become flush with the top of the blocks during the sheeting process.

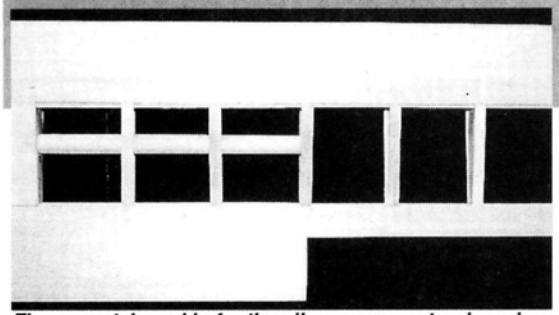
Be careful when you glue the aileron coupler plates into the ailerons. The coupler plates should be glued into the bottom of the top wing aileron and into the top of the bottom wing aileron.

If you like a fast roll rate, all four ailerons can be extended by one rib bay. I chose the squared-off rudder shown in the photos over

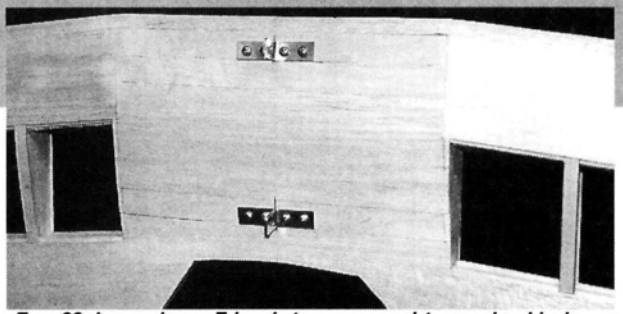


The cabane struts are made of strips of aluminum and are secured to the hardwood blocks with 6-32 screws and blind nuts. The struts are easy to make and to adjust.





The paper-tube guide for the aileron servo extension wires is in the bottom wing. Inserting and routing the wire leads is painless.

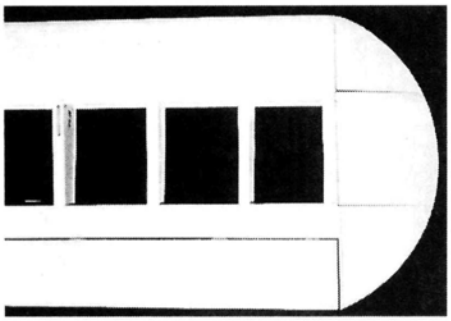


Two 90-degree brass T-bracket are screwed to wooden blocks—a simple top wing-attachment system. Simply bolt the brackets to the top of the cabane struts.

the rounded version shown on the plans.

FINISHING

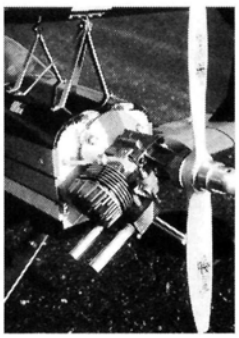
Although my four CR-270s have been covered with the plastic films (to date), I suppose any covering could be used, including the old silk-and-dope method. The fiberglass parts can be painted with any paint that's fuelproof. I painted the cowls on the CR-270s shown in the photos with a solid color.



The wingtips are made of sheet balsa with supports, capstrips and blocks to fair them into the tip rib. Construction is simple and quick.

Then I cut a coordinating color scheme out of rolls of covering, and I ironed it into place. They haven't peeled off during many flights.

If you choose to try this covering technique on the cowl, be sure to use a square of vellum paper to cover the plastic trim before ironing. Otherwise, you will melt and pull paint off the cowl in any place the iron touches.



The SuperTigre 2500 is easy to install. Notice that it's mounted at an angle so that fewer holes have to be cut into the cowl.

FLYING

Double-check the CG and make sure that all the control surfaces move in the correct direction. Taxi onto the runway and point the nose into the wind. When you're ready for takeoff, hold full up-elevator and apply full throttle. As the tail of the plane lifts, release the elevator stick to neutral. When the plane becomes light and ready to lift off, nudge the elevator stick back; relax and watch the model climb to altitude. Don't let the smoothness of the CR-270 scare you; that's just the way it flies.

A few words of caution: when you land the CR-270, don't release the elevator stick until the plane has rolled to a stop. Backwash from the prop going over the large tail surfaces will carry the tail up over the nose; this will result in a broken prop, vertical fin, or both.

With a little stick time, I think you'll agree: the CR-270 is the smoothest plane to land that you've ever had your hands on.

**Here are the addresses of the companies mentioned in this article:*

Fiberglass Specialties, *38624 Mt. Kisco Dr., Sterling Heights, MI 48310.*

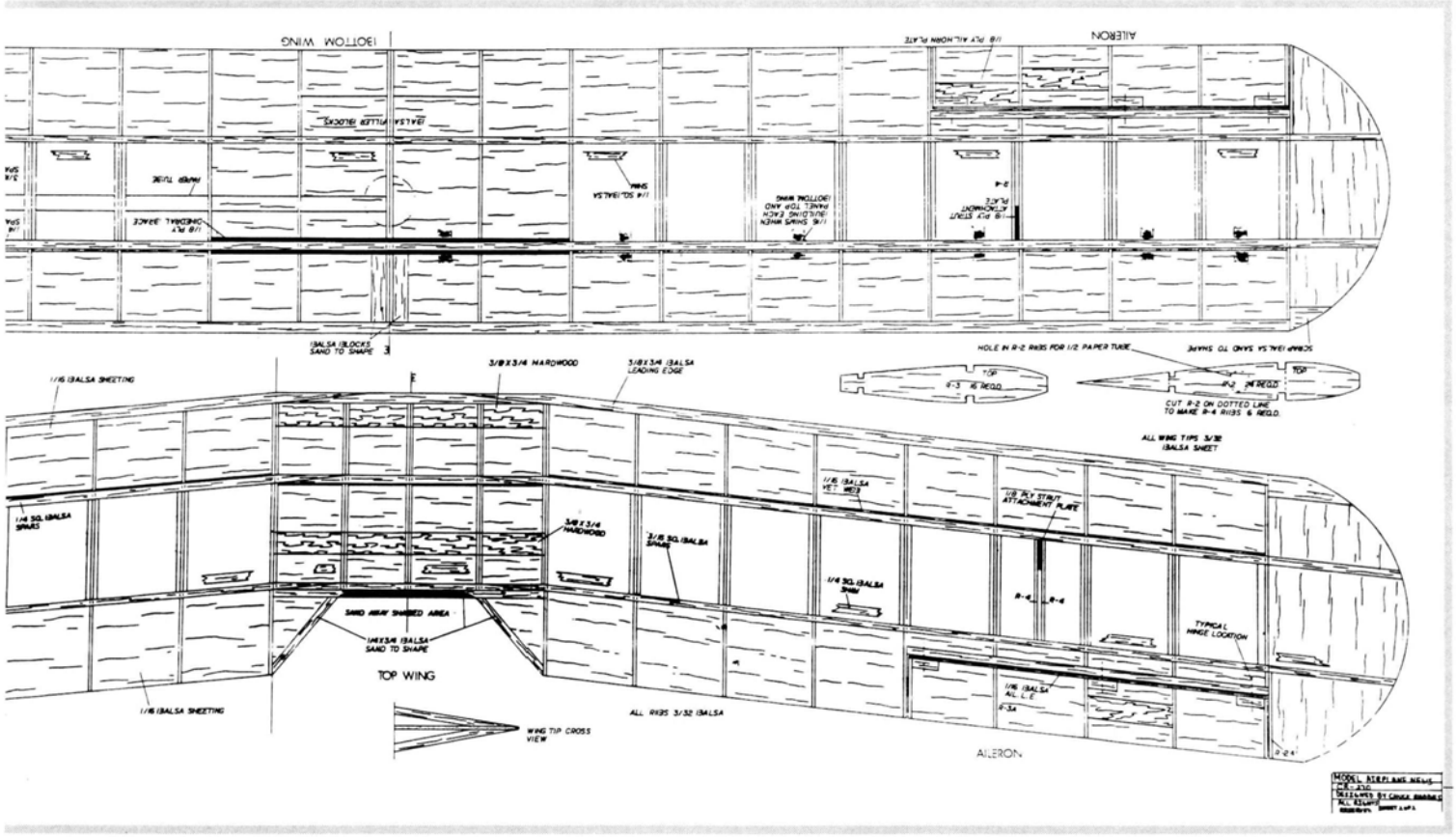
Chuck Rhodes, *20889 County Rd. #6, Coshocton, OH 43812.*

SuperTigre/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

Bennett, *distributed by B&B Specialties, 14234 Cleveland Rd., Granger, IN 46530.*

Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.*

C.B. Associates Products; *distributed by CB/Tatone Inc., 21658 Cloud Way, Hayward, CA 94545.* ■

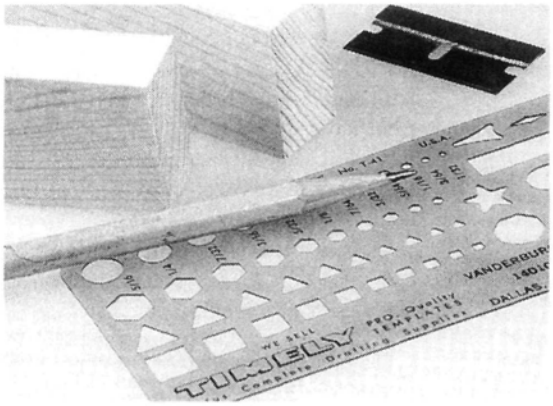


HOW TO:

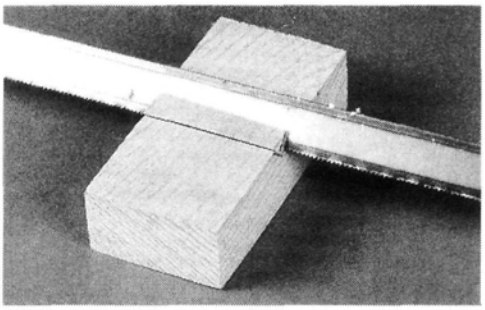
RANDY RANDOLPH

MAKE A TRIANGLE-STOCK STRIPPING TOOL

Triangle stock is very handy in the workshop. It can be used to make fuselage longerons and firewall reinforcing gussets, and it can be used to reinforce servo-mounting rails. The photos show how to make a simple tool that will help you to cut precise triangular strips out of square stock.

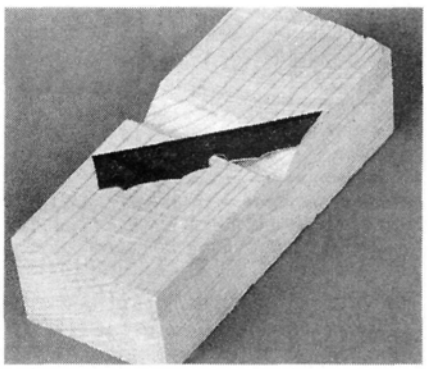


1 *You'll need two 4-inch lengths of 1x2-inch pine or hardwood, a single-edge razor blade, a pencil and a drawing template that has accurate squares. A 45-degree right triangle can be substituted for the template.*

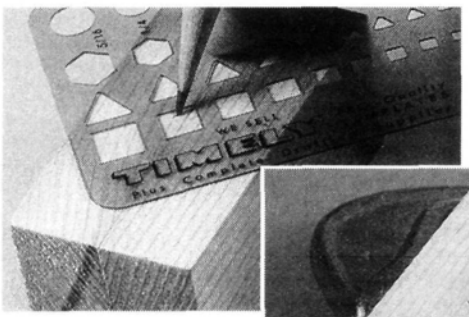


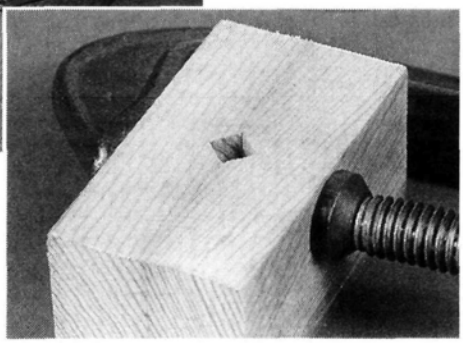
4 *Use a hacksaw, a razor saw, or even a band saw to cut out the vee groove marked on each block. Align the saw blade with the lines marked on the top of the block; then use the parallel lines as guides while you're sawing. When you've finished, the groove's sides should meet at a right angle.*

5 *Break the back off a single-edge razor blade, or break a double-edge blade in half. (Wear eye protection.) Lay it flat, and cement it across the vee groove of one of the blocks. It's important that the blade's sharp edge be close to a 45-degree angle to the block's front face. Mark the block's front face.* ➔

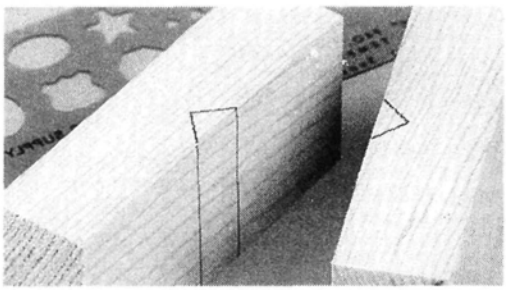


2 *Clamp the two pieces of wood together. Use the template to draw a square that's the same size as the strip to be split—in this example, 1/4 inch. The diagonal of the square must be exactly on the seam between the two blocks. You can also use a 45-degree right triangle to draw the square: align the hypotenuse with the edge of each wooden block, then measure and mark the length of each side of the square.*

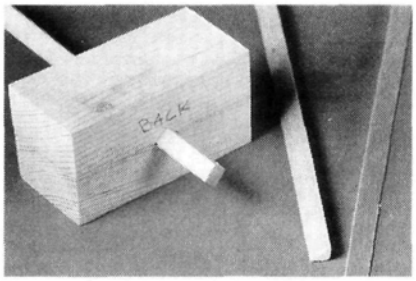




6 *Clamp both blocks together so that the grooves are exactly aligned; be sure that the square stock to be stripped slips smoothly into each end of the tool. If the fit is too tight, you can sand or file the groove to obtain a perfect fit. When everything is ready, epoxy both blocks together.*



3 *Separate the blocks. On the face of each block, draw lines from the end points of the triangle (at the block's edge) straight down the block. A square or a right triangle is a big help when you're trying to make these lines parallel and square to the long edge of the block.*



7 *Label the tool's front and back so that the stock you want to split is always fed into the sharp side of the blade. When the stock has been pushed in through the front of the tool and a few inches are showing at the other end, it can be pulled gently through the tool. Don't pull too fast, or the stock might break.* ■

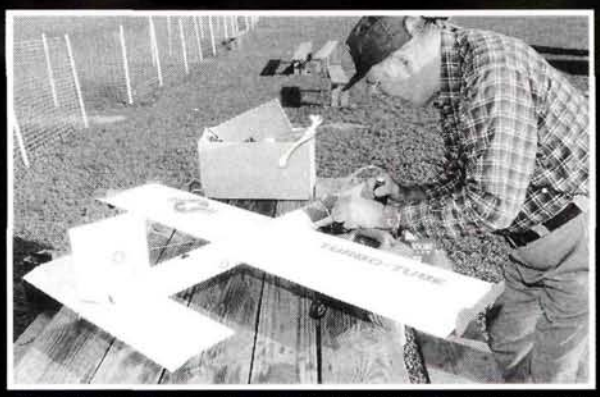
Son of cruise missile?

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

HI-G Turbo-Tube

by STAFF

PHOTOS BY TOM ATWOOD



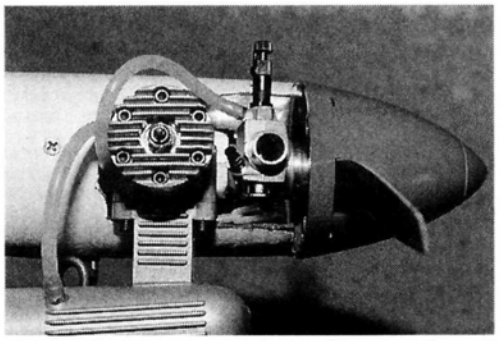
Contributor Dick Purdy, who built the Turbo-Tube for this review, fuels up at the flying field.

Almost every modeler will be intrigued by the unique concept of the HI-G* Turbo-Tube ARF. It certainly raised our eyebrows, and we could hardly wait to assemble the aircraft and wring it out in the air.

CONSTRUCTION

The kit's contents are meticulously packed in separate cells within the box, and the instructions are written just as meticulously, including time-for-completion estimates for each stage of assembly. The design is simple—a metal-foil-reinforced spiral-wound tube with engine, control systems and flying surfaces built into the tube.

Start by installing the engine pod. The firewall, engine mount and tank come pre-assembled in a removable pod. Access to the tank requires dissassembly of the aircraft. The fuel tubing comes connected to the tank and passes through the firewall.

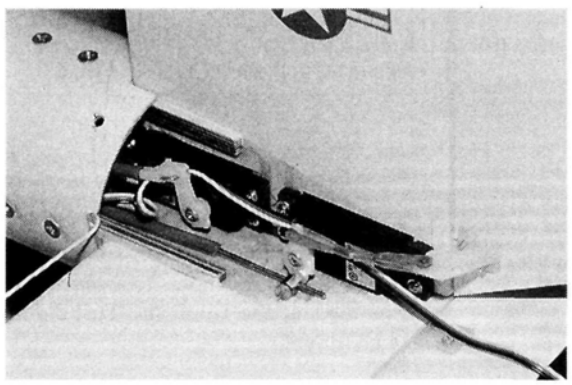


Enlarge the cutouts as required to fit your engine and the muffler, and you must trim the front edge of the tube so that it almost touches the spinner backplate. To strengthen the cut edges and seal out engine oil, apply CA liberally to the edges.

There's no thrust angle; the engine is mounted dead center. After mounting the engine, you must trim back the front edge of the fuselage tube so that it will not quite touch the spinner backplate. To avoid shredding the tube material, cut it slowly and carefully using a fresh X-Acto blade. (With the foil lining on the inside of the tube, achieving a clean cut is a bit of a challenge.) You must also enlarge the slot for the engine's cylinder and muffler to suit.

WINGS

Install the two aileron servos in the tube in the precut holes at the juncture of the wing root and the fuselage. There are two dowels in each foam wing and two metal tubes mounted in the fuselage that receive these dowels. The metal tubes are installed in the fuselage through holes that are precut in the fuselage. One tube is longer so that it can serve as the mounting structure for the landing gear. To prevent the metal tubes from rotating, thread a 3-inch-long piece of piano wire (called a torque rod) through the tail end of the fuselage into holes in the metal tubes. This requires slow, careful effort.



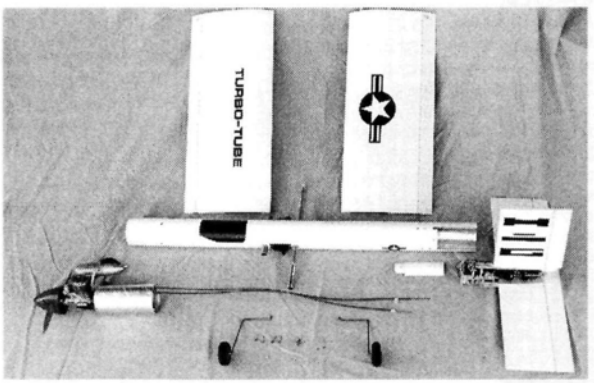
Detail of the rudder and throttle servo in the tail plug.

The wing-mounting tubes come pre-slotted to accept the 5/32-inch-diameter landing-gear. The steerable nose wheel is pre-attached to the firewall. Sullivan linkages to the throttle and the nose wheel extend the entire length of the fuselage and are pre-installed.

THE TAIL

Building the tail required the most effort. The tail feathers are mounted on a wooden form that slides into slots that are precut for the fin and horizontal stab in the tube's tail end. Three servos (for throttle, rudder and elevator), the receiver, a Ni-Cd battery and the switch harness are all mounted on this assembly. You must do some trial-fitting to assemble the tail plug. This is picky, time-consuming work. On the other hand, assembly of the entire plane can be completed by most modelers in a couple of evenings.

Balancing the plane was a snap. It came out right on the money, per the instructions. It demonstrates a wide flight envelope, ranging from very fast flight—with help from a powerful Magnum* .45 2-stroke engine that's recommended for the kit—to ultra-slow, almost surreal flat spins (not recommended).



The kit has few parts, and assembly is simple.

SPECIFICATIONS

Model name: Turbo-Tube 45
Type: Sport aerobat (ready-to-fly, less engine/radio)
Manufacturer: HI-G
List price: $175
Wingspan: 47 in.
Wing area: 440 sq. in.
Weight: 5.2 lb. as built (advertised as 5 lb.)
Wing loading: 26.2 oz. per sq. ft.
Length: 42 in.
Rec. engine size: .40 to .50 2-stroke bb
Engine used: Magnum .45
Number of channels req'd: 4 (5 servos total, 2 for ailerons)

Features: the made-in-the-USA, ready-to-assemble kit has foam wings (pre-painted, pre-hinged/gapless, control horns installed) and a fuselage made of a 3-inch-diameter "custom-constructed and reinforced spiral-wound tube with fuelproof inner and outer layers." The tail feathers come painted, hinged, horned and ready to install. Glue is required only to seal the edges of the cut tube. A complete hardware set—including trike gear, a 3-inch CGM* spinner and installed Sullivan* Skylite wheels—is supplied. Hayes* KM-40 engine mount and 8-ounce tank with fuel lines come installed, as do the nose gear, the steering arm and the Sullivan throttle and steering pushrods. The 14-page instruction manual includes eight photos, some diagrams and the estimated time it takes to complete each detailed step.

HITS

- Flies fast.
- Tracks extremely well.
- Short, brisk takeoff runs; landings are slower than expected (plane slowed nicely).
- Highly aerobatic.
- Modular parts can be assembled quickly.
- Well-written manual.
- Eye-opening appearance will create a stir at the fly ing field.

MISSES

- Access to the tank requires disassembly of aircraft.
- In the review kit, the outside diameter of the wood dowel spars in the wings was so close to the inside diameter of the metal tube into which they fit that humidity changes caused the dowels to swell. They no longer fit. (HI-G replaced the dowels.)
- Precut, finished foam wings save building time and present a very accurate airfoil, but they can be easily dinged or dented; they lack resistance to normal hangar rash. You should keep the wings covered with the supplied foam saddles when the model is trans ported or stored.

FLIGHT PERFORMANCE

by DAVID BARON

• Takeoff and landing

The Tube seemed to be a little nose-heavy, but I thought that the Magnum .45 engine spinning a Zinger* 10.5x7.5 propeller had enough excess power to easily rotate off the runway. I experienced no problems in taxiing, and the plane vaulted into the air after a relatively short takeoff run that was only slightly longer than expected. The climb-out was impressive. I attribute the Turbo-Tube's exceptionally good glide to its clean design. It flares well and is really a pleasure to land.

• Low-speed performance

At slow speeds, the plane handles well, and it has a comfortable stall—not abrupt or violent. I was pleasantly surprised by this because the plane's wing loading is moderately high.

Because of its long nose, this plane is especially easy to trim out. If the rudder is out of trim, there's no mistaking it for aileron trim, and vice versa. The test plane required slightly different elevator trim settings between full throttle and low throttle. I believe this was the result of the slightly nose-heavy configuration. *[Editor's note: CG placement can be a matter of personal preference; the manufacturer may have recommended a conservative location.]*

• High-speed performance

Owing to its great nose length, the Turbo-Tube tracks like water in a gutter. This plane will go wherever you point it. It's a fast aircraft—a lot faster than a trainer and, potentially, a true speedster, depending on which engine and prop you choose.

• Aerobatics

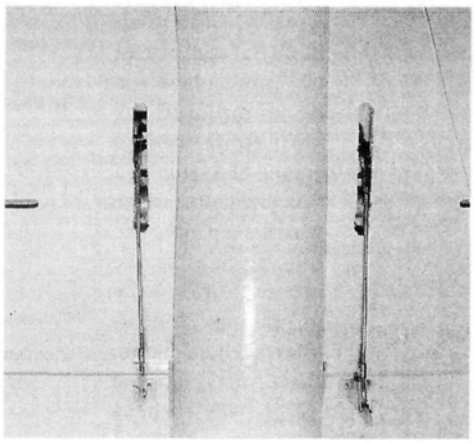
Rolls are fast; you can make them as fast as you're willing to extend your aileron deflection. With only a small amount of attention to get equal and opposite aileron throw, you should be able to do perfect axial rolls. Loops are large but comfortable. Snap maneuvers are quite sensitive to entry speed. The Tube will just do a big barrel roll if you're going too fast.

Spins are fine, but beware of entering flat spins. Our test plane was spinning so flat that the nose seemed to be higher than the tail! At that point, the engine quit, and the plane required at least 10 revolutions to recover. When it finally did recover, the altitude was getting critical! We almost dug a Turbo Tube trench.

To recover from a flat spin, I used full opposite rudder and full deflection of the aileron in the direction of the spin! My theory is that you need to get the inside wing flying again. I don't recommend that you practice flat spins with your Tube, but if you do and you need to recover and nothing else will work for you, keep in mind how I recovered. *[Editor's note: the manufacturer comments that engine power is typically required to recover from a flat spin; snap roll performance will improve with a more aft CG.]*

• Conclusion

Although many people will only cast a wayward glance at airplanes that don't have a traditional look, they'll react differently to the Tube because it's almost futuristic (but not quite—after all, at any large airport, you'll see quite a few aircraft with perfectly round fuselages!) It has a very wide speed range owing to its comfortable handling at slow speeds. Its low-drag shape makes very high-speed flight merely a function of which propeller and engine you bolt on the front. It would be great fun to dress up a Turbo Tube as a sidewinder missile and chase your friends around the sky.



The aileron servos are mounted in precut holes in the side of the tube. The wings are slid on with the servo arms rotated down; after wing installation, the arms are rotated up for connection to the aileron linkage.

CONCLUSION

If you want a novel "rocket-ship" design that takes only a few hours to assemble and opens eyes at the field, the Turbo-Tube may be for you.

**Here are the addresses of the companies mentioned in this article:*

HI-G, *2131 E. Crocus Dr., Phoenix, AZ 85022; (602) 788-5209.*

Magnum; *distributed by Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728.*

Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*

Sullivan Products; *distributed by Swenson Specialties, P.O. Box 663, 2895 Estates Ave., Pinole, CA 94564.*

Hayes Products, *2610 Croddy Way, Unit A, Santa Ana, CA 92704.*

Zinger; *distributed J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.* ■

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

CUSTOM R/C AIRCRAFT'S

YF-22

by GEORGE LEU

PHOTOS BY GEORGE LEU

FOR THE '90s and beyond, the YF-22 advanced tactical fighter (ATF) is what our nation's Air Force will pin its hopes on. To date, only two have been built, and they're joint products of Lockheed, General Dynamics and Boeing Electric. The YF-22 was selected in preference to the YF-23 McDonnell and Northrop prototype in the fall of 1991.

The YF-22 resembles the F-18 Hornet and F-16 Falcon. Its large, wide body looks like the F-117A Nighthawk's, but its fuselage lines are smoother and more appealing. Viewed from some angles, it's graceful, but from others, it's "stubby." It will never be confused with the sleek T-38 Talon or F-104 Starfighter.

I first heard about this George Miller Custom R/C Aircraft* kit from friends who had attended the '91 Southwest Fan Fly. They raved about its performance and unique profile

A.T.F. (Advanced Tactical Fun)

while airborne. I had met George Miller at the 1990 Southwest Fan Fly, and I had complimented him on the F-8 Crusader, which I had recently built from one of his kits. He was already known as a designer and flier of R/C ducted-fan aircraft, and I learned much about his approach to the designing and manufacturing of custom R/C kits.

George Miller's objectives are to offer customers performance, reliability and simplicity.

- **Performance.** A small compromise in true scale outline yields great performance benefits while detracting only slightly from the plane's overall scale appearance.
- **Reliability** is a key element of all the Miller designs. The Custom R/C kits use a single Byro-Jet* for power because this fan/engine setup has proved its reliability

over more than 15 years. Spring-Air* retracts are used in all the designs because of their automatic, reliable "down-lock."

• **Simplicity.** If one strategically placed bulkhead will serve the function of two, George will have you install just one. This reduces the amount of material used in a particular design, and that means less weight. With ducted-fan aircraft, weight and performance are directly related.

The parts as they come out of the box.

THE KIT

The fuselage is made of polyester resin, and the halves are joined at the sides, not at the top (which is more usual with fiberglass fuselages). I don't know the reason for this (perhaps ease of manufacturing), but as a modeler, I *do* know that the joint required no filling. Actually, the joint falls within areas that require no filling in any situation, i.e., the wing and stab attachment areas and the angular top/bottom break on the nose of the fuselage. This subtle design feature is ingenious because when you don't have to fill a seam, you avoid adding that filler weight.

There were only four pinholes in the fuselage, and I filled them with one wipe of filler. Notches on the fuselage show where the stab mechanism, the fin and the bulkheads should be attached. I appreciated these marks, because it's often difficult to take measurements on a fuselage that has compound curves.

The foam wings were cut well and had some factory-applied filler on their tips. All the balsa and plywood parts (stabs, fins, engine-mount bulkhead, wing sheeting, etc.) came already cut out—much easier than having to deal with a stack of uncut wood.

Used with the full-size plans, the instruction manual is sufficient. The kit might seem complicated; just start building, and as you move along, you'll see the solutions to any problems you might have. There were times when I stopped work because I wasn't sure whether I was doing the task correctly; but when I studied the plans and photos and reread the manual, the "questionable" step became the "obvious" step.

Throughout this project, I used Pacer's* Zap-A-Dap-A-Goo because it really sticks well. For fillet work around the bulkheads, I mixed it with baking soda. For many of the fuselage joints, I used Ambroid glue because its acetone base slightly melts the resin and forms an excellent bond when it's dry. (Epoxy glues don't stick well to polyester resin.)

SPECIFICATIONS

Model name: YF-22
Type: Stand-off-scale ducted-fan jet
Manufacturer: Custom R/C
List price: $400 (plus S&H)
Wingspan: 52 in.
Wing area: Approximately 700 sq. in. (not including "lifting body"-area)
Weight: 11.5 lb. (review aircraft: 12.5 lb.)
Length: 75 in.
Engine: O.S. .77 (with OPS 300 glow plug and Byrojet fan)
No. of channels req'd: 6 (aileron, elevator, throttle, steering, retracts, gear doors)
Radio used: JR Max 6 PCM
Fuel: Byron 5-percent-nitro jet fuel
Kit construction: Fiberglass, plywood, balsa, foam (wings)

Hits

• Construction methods produce a light, strong model. Fiberglass fuselage has seam on the side, not on the top.
• Balsa for fins, stab and wing arrive cut to correct sizes.
• Plane flies very well—off grass or pavement—even with extra weight of scale details.
• Unique, striking appearance on the ground and when airborne.

Misses

• Instruction manual needs to be more explicit in certain areas.
• I'd like an operational rudder system.

CONSTRUCTION

It's important to follow the instruction manual's assembly sequence. The key step for a well-aligned aircraft is making sure the fan-housing bulkhead and retractable main-gear bulkhead were square with each other and with the fuselage. The alignment notches in the fuselage were helpful in ensuring that the bulkheads were properly positioned.

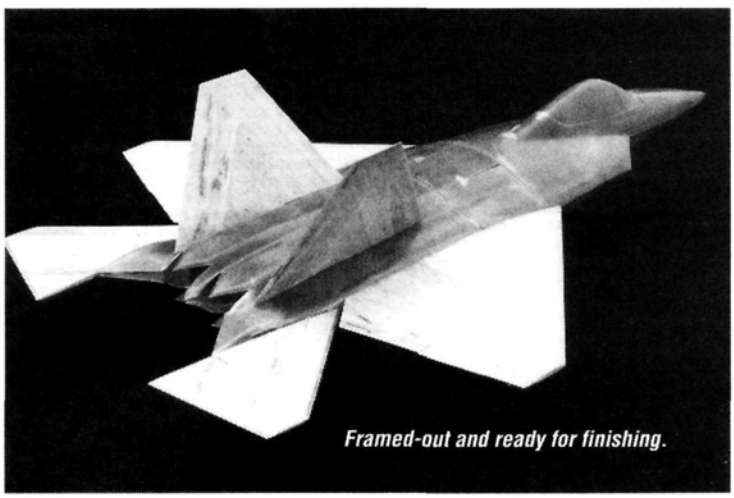
JR Max computer radio.

The fuselage bottom is flat, so when I attached the wings, I simply put the fuselage on a level table and measured upward to ensure that the wingtips were exactly the same height from the table.

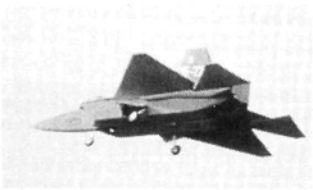
Having attached the wings, I installed the stab mechanism, making sure that it was aligned with the wing panels. The stabs were built and then joined over the stab mechanism already installed in the plane. This was the only area in which finesse was required; I was worried about warping the structure while the glue was drying, but the stabs turned out to be perfect.

The vertical fins are the last surfaces to be added to the plane. Alignment notches on the fuselage show the top and bottom positions for the brass tube that's built into each fin. These notches also provided the correct fin angle for the YF-22.

Because 60 percent of the aircraft is behind its CG, it was important to install the radio equipment as far forward in the fuselage as possi-



Framed-out and ready for finishing.



FLIGHT PERFORMANCE

• Takeoff and landing

Off grass, performance was good; takeoff required about 150 feet. Off pavement, performance was terrific; it took approximately 100 feet to get airborne. Steering was set for ¼ inch of movement in each direction. The landing gear's wide track made the plane stable during takeoff. It didn't show a tendency to ground-loop. Climb-out from takeoff was done at full throttle, and there was no mushing into the air. The plane flew with authority. The ailerons were very sensitive to high-rate settings and perfect at low-rate settings. Elevator was comfortable at high-rate settings and is recommended for landings and takeoffs. During regular flight, high rate on elevator wasn't necessary; low-rate elevator was fine for cruising. The down-leg of the landing pattern should be done at about half throttle until you're on base leg; at that time, reduce throttle to about a quarter. Allow time for speed to bleed off, but be prepared to apply small amounts of throttle to keep up air speed. Full elevator at touchdown gives a nice flare to landings.

• Low-speed performance

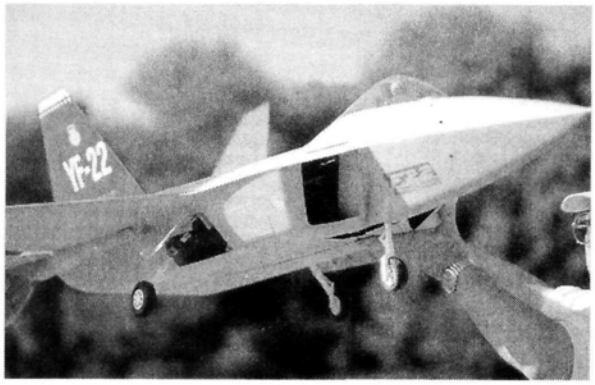
The YF-22 can be flown at lower speeds and higher angles of attack without a problem, but a fair amount of power must be applied to maintain altitude. At low power settings, this design has a very steep rate of descent, so care must be taken. Stalls, however, are straight ahead without any tendency to drop either wing. There is, however, plenty of aileron and elevator response for positive control. At lower speeds, the elevator slightly loses sensitivity, so keeping the dual-rate switched on high rate is recommended.

• High-speed performance

Compared with my 140mph Miller T-38, the YF-22 seems slow, but it probably flies at 120mph. Most people were surprised at the O.S. .77's performance on Byrojet 5-percent-nitro jet fuel. The plane is a good high-speed design and a true show-stopper during a screaming low pass.

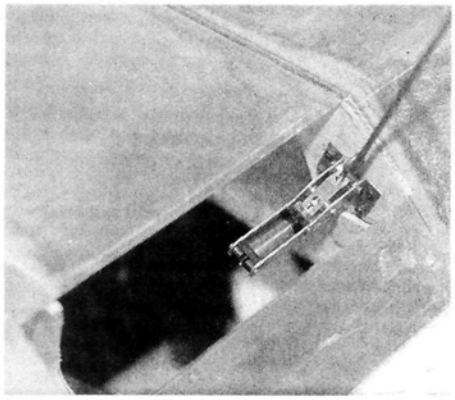
• Aerobatics

Aerobatics are full-scale, jet-like and very impressive, but as a former pattern competition flier, I missed rudder control. This model's forte is smooth axial rolls, inverted flight, split-S's, large, soaring loops, etc., but the in-flight appearance (shape) is unique, to say the least, so get used to it before you go wild and have a great time.



ble. I used a 900mAh battery pack to help with the balancing and to ease my mind with regard to flight capacity.

My YF-22 isn't finished the way George Miller suggests it should be. I have increased its scale potential for competition purposes. The extra details look good, but they *do* add weight—about 1 pound. A YF-22 with MonoKote* stabs, wings and fins could conceivably weigh about 10½ pounds, ready to fly.



View from engine cut out hole on top of fuselage showing retracts on firewall.

RETRACTS

As their name implies, Spring Air retracts are a combination of pneumatic and spring mechanisms. They retract using air and extend mechanically because of a spring in each unit. This makes them very reliable; regardless of the system's air pressure, the spring ensures gear extension. Spring Air retracts also offer an advantage that other brands don't: each unit requires one air line, not two, and it's easier to route just a single line through the fuselage.

I've used Spring Air products for years, especially when I competed in pattern flying, because a retract failure during landing would have meant a score of zero.

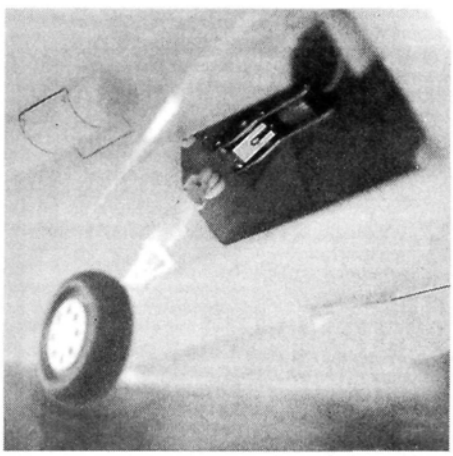
RADIO

I used my JR* Max 6 PCM radio. It's my favorite radio for jet flying because it has a display screen, and it allows you to dial in specific amounts of dual-rate control both for aileron and elevator. Low-rate settings on elevator and aileron for the YF-22 are 66 percent of the movement suggested in the manual. The JR servos easily handle the full flying stab. A reliable radio does a lot to build confidence when you fly.

MARKINGS

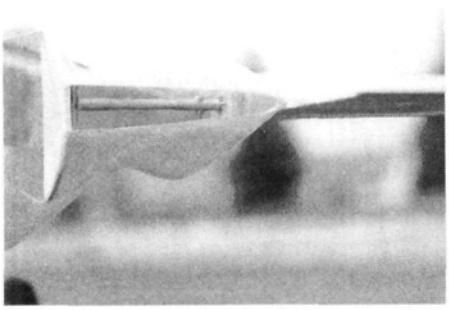
This was my first opportunity to use dry transfers, and they were provided by Total Aerographic Services* (TAGS). These particular markings are for the prototype YF-22, and they're a perfect match to my documentation.

The advantages of dry transfers over wet or sticky ones include: they're easy to position; they don't have an unsightly border; and there's no mess to clean up. The transfers went on quickly and easily and are just the right scale for the Custom R/C airplane kit. (I also recommend that you use the TAGS burnisher tool.)



Close-up of Spring Air retract installation. Kit is designed for these dependable units.

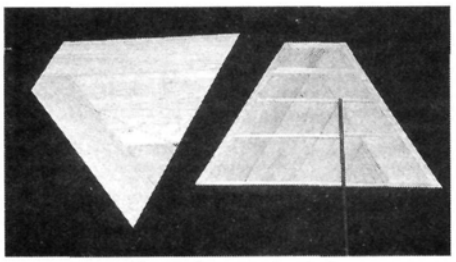
Close-up of gear-door prior to finishing.



View from rear showing the flying-stab's pivot-tube and torque-rod mechanism.

Even though the details increase the plane's weight by 1 pound, I think it was worth it; the plane took first in Stand-Off Scale at the 1993 WRAM Show.

My faith in George Miller's design inspired me to make the YF-22 as appealing as possible. It's important to remember that my modifications are only cosmetic. I never re-engineer or re-design any part of a kit, because I always trust the manufacturer



Fins being constructed.

to know his product better than anyone who buys it.

CONCLUSION

Building the George Miller Custom R/C Aircraft YF-22 went smoothly, and it flies well. Controlled by my JR radio, with the Spring Air retracts and the TAG dry transfers, my YF-22 is an awesome package. At jet rallies and trade shows, it's a real eye-catcher, and it should do very well in scale competition events.

**Here are the addresses of the companies mentioned in this article:*
***Custom R/C Aircraft,** 1140 Civic Center Dr., Rohmert Park, CA 94928; (707) 584-9446.*
***Byro-Jet;** distributed by Byron Originals, P.O. Box 279, Ida Grove, IA 51445.*
***Spring Air Products,** 82 Parkhill Blvd., West Melbourne, FL 32901; (407) 728-9002.*
***Pacer Technology & Research,** 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*
***MonoKote;** distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826; (217) 398-3630.*
***JR Remote Control;** distributed by Horizon Hobby Distributors, P.O. Box 3726, Champaign, IL 61826.*
***Total Aerographic Services,** 3630 August Bartlett, TN 38133; (901) 286-7760.* ■

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

by JIM ONORATO

PHOTOS BY WALTER SIDAS & JIM ONORATO

Great Planes

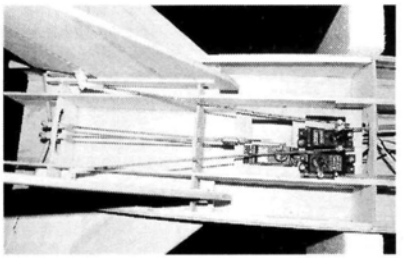
f-15 EAGLE

THE FULL-SCALE USAF F-15 Eagle is the most advanced, most capable, high-speed fighter ever developed. From the beginning, it was evident that this 64-foot-long, 43-foot-span aircraft was a superior air fighter. The F-15 Eagle broke eight time-to-climb records in 17 days, shattering all previously existing marks and bringing the world time-to-climb record back to the USA by soaring to 98,425 feet in 207.8 seconds.

Dick Purdy (left) assists the author.

"I have never built an airplane this quickly—I framed the entire plane in five days! The engineering on this kit, including the "Auto-lock" assembly method, is truly outstanding."

Top Gun fun in an advanced aileron trainer



This detail of the aft fuselage shows the elevator, rudder and throttle servos.

During Operation Desert Storm, F-15s accounted for the majority of air-to-air victories against Iraqi forces. Now Great Planes* brings the excitement of flying an F-15 Eagle to pilots who prefer to keep their feet on the ground.

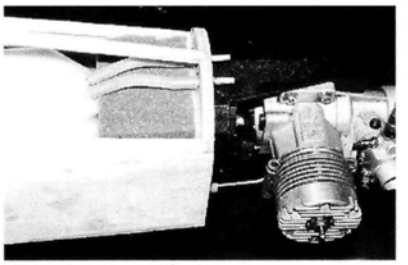
The Great Planes F-15 is a high-performance, propeller-driven sport airplane that resembles the full-size F-15 Eagle. In the air, the prop is invisible, and that adds to the realism. With the F-15, you can enjoy the thrill of flying a jet-like airplane without incurring the complexity and high cost of a ducted-fan model. Because of its low speed stability, it offers a good entry into high-performance jet-like aircraft.

Great Planes recommends this plane to those who have mastered an aileron trainer and are confident in their flying skill, i.e., as a suitable second airplane. However, this is not for first-time fliers. It can be very fast and highly maneuverable, and does not have the self-recovery characteristics of a basic trainer.

THE KIT

The high quality of this kit is evident from the moment you open the beautifully decorated box. The die-cutting is clean and accurate, and the materials are of excellent quality. The Eagle is made almost entirely of balsa, and its only plastic part is the canopy. The kit includes an adjustable engine mount, landing gear, complete hardware package, canopy and an extensive decal sheet. The items, supplies and tools that you'll need to complete the model but that aren't supplied are identified in the superb, 52-page instruction manual. There are two rolled sheets of full-size plans.

An optional Armament Package (GPMQ5010) that includes four Sparrow missiles that are mounted on the fuselage and 12 MK-82 bombs to mount on wing pylons, is available separately for use with the F-15 Eagle as well as with Great Planes F-14 Tomcat and Patriot airplanes. I opted to add the armament to my Eagle.



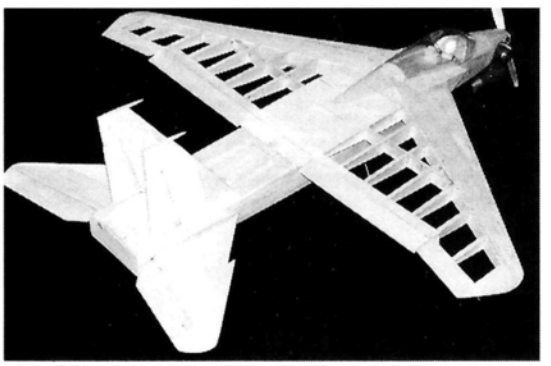
Detail of the fuel tank installation.

CONSTRUCTION

I used Pacer Technology* Zap, Zap-A-Gap, Slo-Zap and Plasti-Zap CA glues and Zip Kicker accelerator for most of the construction. I used Z-Poxy to attach the firewall, the landing-gear mounting plate, the wing-bolt plate, fins and stab.

TAIL FEATHERS

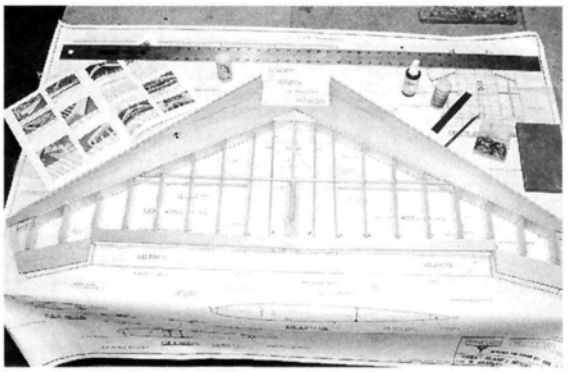
The fins, rudders, stabilizers and elevators are constructed of pre-cut, ¼-inch sheet balsa parts that go together quickly. I sanded the trailing edges of the fins and elevators to a thickness of 3/32 inch to give them an airfoil shape. The elevators are actuated with torque rods that allow the linkage to be concealed inside the fuselage.



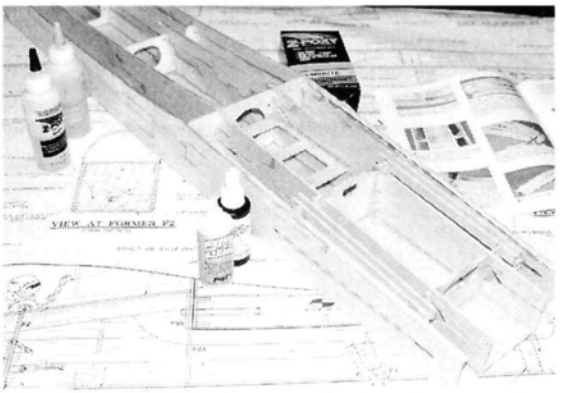
The airframe has been framed and is ready for covering.

FUSELAGE

The fuselage sides are each made up of three ⅛-inch die-cut balsa parts with ⅛-inch balsa doublers (also made of three die-cut parts). All the pieces fit together perfectly. The fuselage uses the Great Planes Auto-Lock construction that allows you to slide the formers through horizontal slots in



The wing framework is shown with the leading-edge sheeting and shear webs in place.



Great Planes' Auto-Lock construction locks formers and other fuselage components into place.

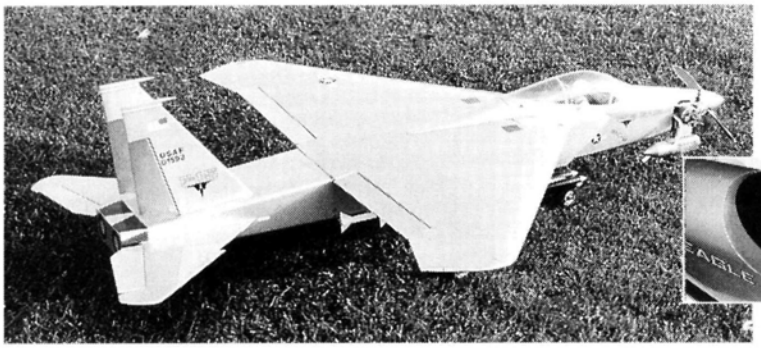
SPECIFICATIONS

Name: F-15 Eagle (kit F154)
Manufacturer: Great Planes Model Mfg. Co.
Type: Sport-scale jet-like airplane
Wingspan: 47 in.
Wing area: 615 sq.in.
Airfoil: Symmetrical
Weight: 7 lb., 11oz. (inc. armament and 4 oz. of lead)
Wing loading: 28.8 oz./sq.ft.
Length: 52.5 in.
No. of channels req'd: 4 (with dual rates)
Rec. engine: .40 to .50 2-stroke
Engine used: O.S. .46SF
List price: $149.95

Features: the fuselage is sheet balsa over plywood formers with interlocking construction. Tail surfaces are ¼-inch sheet balsa. The wing uses "double jig-tab" construction that allows the wing to be built on a flat surface with the correct washout and dihedral. Kit includes an adjustable (.40 to .70) engine mount, formed landing gear, pre-cut balsa shear webs, vacuum-formed canopy, extensive decal sheet and a complete hardware package. Two rolled sheets of full-size plans and a superb 52-page instruction manual are provided.

Hits
- High-quality materials and die-cutting.
- Fully detailed, step-by-step instruction manual.
- Complete hardware package.
- Unique wing construction with built-in washout.
- Excellent flight performance with low-speed stability.

Misses
- Some discrepancies between decal sheet and photos.
- Fuel tank is inaccessible, unless you build in a hatch.



The swept planform of the F-15 and wide fuselage contribute to its slow flight stability.

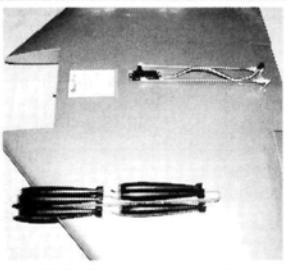
Detail of cockpit.

the fuse sides and then simply twist them into a vertical, locked position. The formers are then keyed into notches in the fuse bottom to lock everything together in perfect alignment. This design makes it practically impossible to install a former incorrectly. At this point, I Zapped all the joints with thin CA and followed up with Zap-a-Gap.

The turbine sides are also made of 1/8-inch die-cut balsa, and they're attached to the fuse formers that protrude from the fuse sides. What you end up with looks like three fuselages glued side by side.

After installing most of the top and bottom sheeting, I temporarily set the servos and engine into place so that the nose wheel and throttle pushrods could be installed. I found a typo in step 1 on page 18. The size of the pilot hole should be 7/64 inch not 7/16 inch.

The fuel tank was installed next. I did not like the idea of permanently installing the tank without an access hatch, but I did so anyway. I figured I could easily cut a hatch in the underside of the fuse if and when I needed access to the tank.

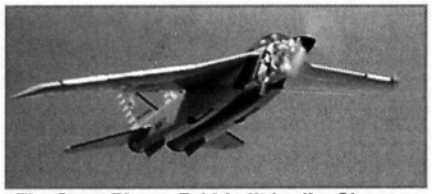


Six MK-82 bombs from the optional armaments kit are shown mounted under the wing.

The sheeting provided for the top of the fuse, forward of the cockpit, was 1/8 inch thick instead of the 3/32 inch called for in the instructions; it was much too hard to bend to the required shape—not a major problem, though. I just substituted a piece of 3/32-inch sheeting, and everything worked out well. I also

(Continued on page 115)

YOUR NEXT JET



The Great Planes F-14 built by Jim Simpson.

If you want to experience the jet-like flight performance of the sleek, new Great Planes tractor-jets, which aircraft should you start with? The F-15 Eagle, the most recently introduced jet, is in fact the easiest to fly. It offers exceptional slow-flight stability, and, hence, is the best first jet for the advancing pilot who has mastered the aileron trainer. In a nutshell, the F-15 is the simplest to build and the easiest to fly of the trio.

The Patriot, reviewed in our August '92 issue, was the first jet released by Great Planes. Great Planes notes that this very fast aircraft is much more of a challenge in the air than the F-15. Reviewer Tim DiPeri described this plane as a "top-performing, high-speed aerobat." The Patriot's recommended engine is a high-performance .40 or .46. Its construction is almost all-balsa and is similar to that of the Great Planes Ultra Sport kit.

The Great Planes Patriot built by Tim DiPeri.

The F-14, reviewed in our March '93 issue, is designed for a .60 to .75 2-stroke and has a 58¼-inch wingspan. Reviewer Jim Simpson commented that this plane offers "jet-like speed with good stability."

The Patriot and the F-14 are several flying skill levels up from the F-15; both require a proficient sport pilot who is comfortable with high-performance sport aircraft. Choose the F-15 if you want an easy-to-build, easy-to-cover and easy-to-fly jet-like sport plane with rugged fixed gear that can take a pounding. (It can be viewed as an advanced trainer jet.) Choose the F-14 or the Patriot if you want optional retracts, more power and still more high-speed, jet-like performance.

FLIGHT PERFORMANCE

The ads say that the Eagle is the easiest of Great Planes' three jets to fly. They also say, "If you can fly a trainer, you can handle this jet!" I must say, I was a bit skeptical when I took this awesome-looking plane to the flying field for the first time.

• Takeoff and landing

All of my test flying was done off a closely cut grass field. I set all the transmitter dual-rate switches to high rate and pointed the Eagle into the wind. The Eagle tracked extremely well without any rudder input. I let it build up as much speed as the runway would allow, then I smoothly applied a little up-elevator—and then a little more— until it was finally airborne. I had balanced the plane a little nose-heavy, so it took a good distance to lift off. Once in the air though, it climbed out nicely with the wings perfectly level.

The landing went just like the instruction book said it would. The aerodynamic design of the F-15 gives it a flying quality not often found in R/C models. As I applied up-elevator to raise the nose and slow the plane, the fuse started to lift. Once the plane entered this "floating" stage, it was still very controllable and slowed down for a very gentle landing. The trick to making smooth, slow landings is to use the elevator to slow the plane earlier than usual, allow it to enter the floating stage and then use the throttle to regulate its rate of descent.

• High-speed performance

This is where the F-15 really excelled! High-speed passes and victory rolls were very impressive. I didn't notice any instability in the high-speed maneuvers, and no trim changes were required as I changed speeds. The plane can be flown really fast and is very responsive at high speeds. Application of rudder at high rate made the plane roll rather than yaw. As the F-15 darted around the sky, it was hard to tell it wasn't a ducted-fan jet. Only its quietness gave it away.

• Low-speed performance

I was frankly surprised at just how slowly the F-15 was able to fly without stalling. I flew it low and slow for many of the camera shots, and it remained stable the whole time. The built-in washout certainly contributes to its outstanding low-speed stability.

• Aerobatics

The F-15 wasn't designed for aerobatics. Stall and snap maneuvers are not its forte. It will loop and roll well, but it isn't very good at spins. It flies inverted with almost no down-elevator. With ailerons at high rate, the rolls are so fast that there isn't time for any elevator input; but none is required. The plane is most sensitive along its roll axis, is less sensitive in pitch and is almost insensitive in yaw. Application of rudder at high speed induces a rolling dive.

I agree that if you have full confidence in your ability to safely fly an aileron trainer, you'll be able to handle this jet. If not, I strongly suggest that you seek the assistance of a competent R/C pilot to help you with your first flights.

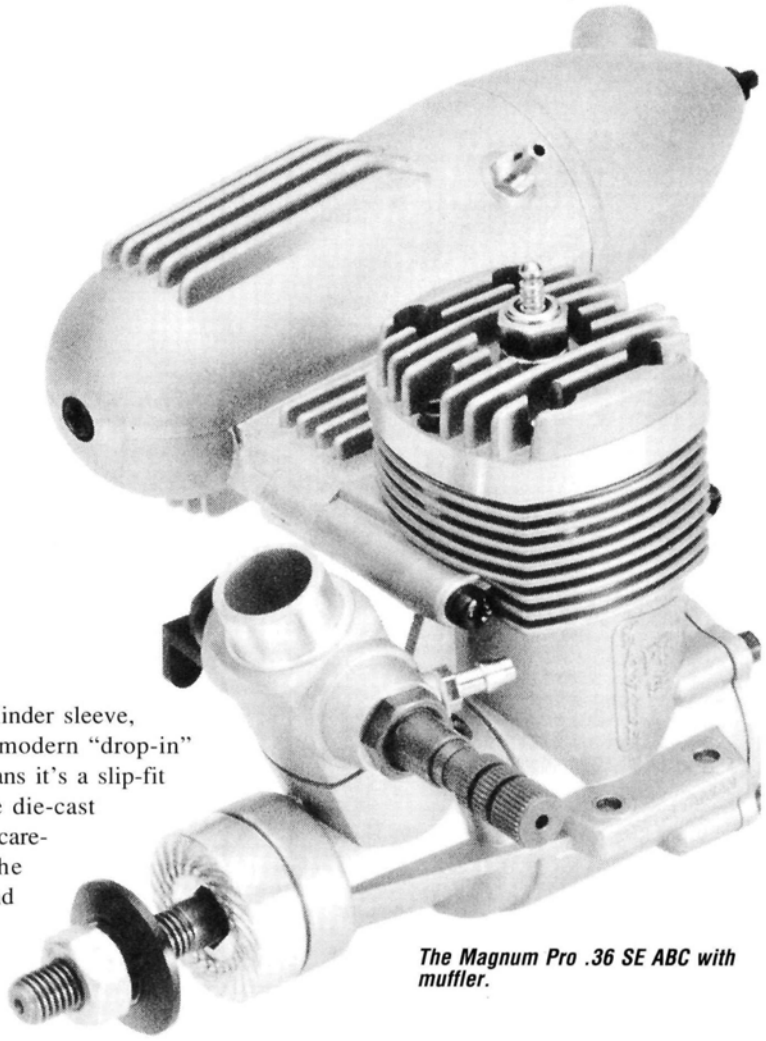
ENGINE REVIEW

by DAVE GIERKE

Real Performance Measurement

In-flight testing

MAGNUM PRO .36-SE ABC



The Magnum Pro .36 SE ABC with muffler.

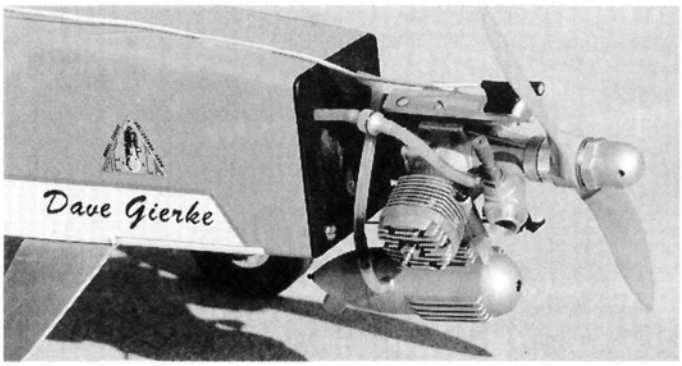
THE SUBJECT OF this review is manufactured by the Thunder Tiger Model Co.*, Taiwan, Republic of China. The Magnum series of engines is distributed in the U.S. by Global Hobby Distributors.

There was a time when engines coming from Taiwan were not on a par with those coming from Japan, Italy, Germany and other countries. Times change, but initial perceptions don't. When *Model Airplane News* forwarded the Magnum Pro .36 to me for evaluation, I wondered if it warranted devoting 20 to 30 hours of hands-on appraisal time to it, then I opened the box.

My initial reaction was, "The engine looks nice—lots of wrenches, instructions and decals—an impressive package. But let's get to the good stuff; take it apart and see how the Magnum Pro compares in materials, construction, quality of machining and fit." Since this was my first experience with any of the Thunder Tiger engines, other than seeing a few of them on the flying field, I didn't know what to expect.

The Allen wrench intended for removal of the head and backplate metric cap screws was the wrong size. Fortunately, I had one that fit. The engine disassembled easily, including the cylinder sleeve, which is of the modern "drop-in" variety. This means it's a slip-fit into the pressure die-cast crankcase. I was careful to mark the cylinder head and connecting rod, so I could identify the front from the back for reassembly purposes.

My first question concerned the cylinder; it definitely was nickel-plated brass—not ABC (aluminum piston with a brass, chrome-plated cylinder). The box and the instructions state that the .36 is an ABC *type* engine. I guess nickel-plated brass qualifies as an ABC type; however, I would call it an ABN. Aluminum pistons with brass, nickel-plated cylinders function very similarly to the ABC variety, but they don't last as long. A chrome-plated cylinder can outlast several pistons.



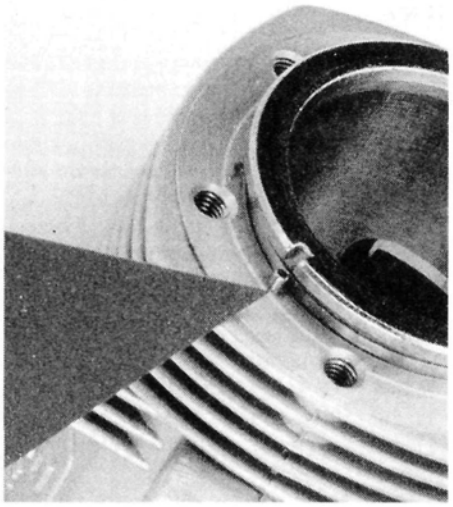
The Magnum Pro .36 almost gets lost on the front of the Airtrax 40 test mule, but it performs admirably!

ABC PISTON AND CYLINDERS

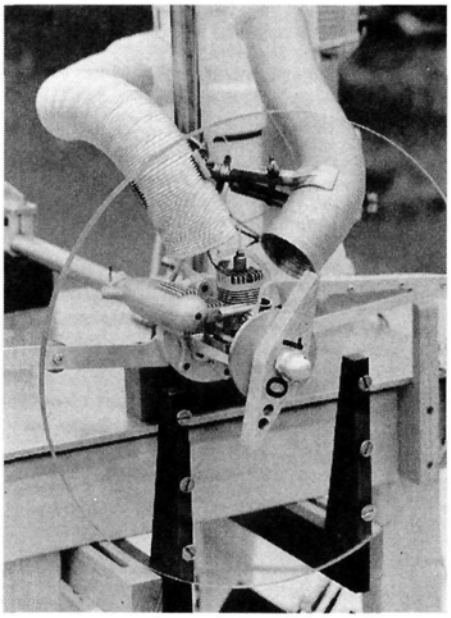
Longevity aside, the piston-to-cylinder fit was excellent. It was nice and free below the ports while transitioning to an interference fit above the transfer and exhaust ports. Thunder Tiger explains this phenomenon in their *general operating instructions:* "When the engine runs, the cylinder of the engine expands due to the heat of...combustion. The top of the cylinder becomes much hotter than the bottom. The ABC-type cylinder liner has been precisely machined so that when the engine is at its optimum running temperature, the sides of the cylinder are straight and the piston can travel freely up and down." I would only add that this procedure is intended to maintain *good combustion gas seal* at operating temperatures.

Designers of modern 2-stroke glow engines have a "catch 22" situation on their hands concerning the tightly fitting ABC pistons. Although the ABC system works and provides unprecedented indicated (cylinder) horse-

PHOTOS BY DAVE GIERKE



The cylinder-sleeve alignment pin is a nice touch.



Another view of the Magnum Pro .36 on the dyno. Notice the remote glow-plug heat-system connector in place. Cooling is important when there's no prop blast!

Rpm Obtained with a Variety of Props

Prop	rpm
Zinger* 11x8	8,000
APC 11x8	9,400
Master Airscrew 11x7	9,800
APC 10x9	9,800
Rev-Up 11x7	10,200
APC 11x7	10,400
APC 9x10	11,000
APC 10x8	11,300
APC 10x7	11,700
APC 10x6	12,500
APC 9x7.5	13,200
APC 9.5x8.5	13,300
APC 9.5x8	13,500
APC 9.5x7	14,400

power, there is a problem with heat transfer and cooling with the top of the cylinder. The slip-fit mentioned earlier doesn't allow efficient heat transfer to occur to the upper crankcase cooling fins. The poor mechanical contact forms a thermal dam similar to a high resistance in an electrical circuit.

In the late 1940s and '50s, designers were very concerned with the same problem—even though the ABC concept was years away from formulation. The *McCoy .60 red head* racing engine is a good example of how the heat transfer problem was handled. The McCoy (holder of all the D-speed records of the era) was a ringed piston engine. The primary route for the piston to cool is through the rings to the cylinder. Since the cylinder had to cool efficiently to ensure heat transfer from the piston, it had its aluminum-alloy crankcase heat-shrunk around its steel circumference. The idea was to maintain mechanical contact and prevent the thermal dam from interfering.

Unfortunately, there were two problems with this system. First, the aluminum crankcase expanded faster than the steel cylinder. Second, since the upper crankcase, with its cooling fins, cooled unevenly, it tended to become distorted, taking the cylinder along with it. If severe enough, the rings would fail to seal, allowing blow-by of combustion gases. One of the speed secrets of these racing McCoys involved honing the inside of the crankcase until the cylinder could slip in—a "drop-in liner"—just like many of today's ABC engines. In those days, extra air was directed to the cylinder *head*, helping it to accept more of the cooling load. Today's ABC designs allow the cylinders to float, to minimize distortion, which is more critical with the close-fitting pistons. The cylinder head is expected to provide the majority of the heat transfer and cooling.

The problem for the ABC setup centers on the piston losing its tight interference fit through the repetitious starting from ambient to operational temperatures. Most of us who have owned and flown ABC engines have experienced the older unit that has lost its tight cold piston fit; the excessive piston/sleeve clearance when hot allows combustion gases to blow by the piston, thus losing power and efficiency.

Hmm...a difficult problem. But consider this: if heat transfer and cooling could be improved for the cylinder above the ports to keep the sleeve from becoming distorted, the cold piston fit wouldn't have to be so tight. Wear because of start-up friction would be greatly reduced. Look for new cylinder alloys and innovative cylinder heat-transfer methods for future engines. The promise

PROPELLER PERFORMANCE

Engine: Magnum Pro .36 SE ABC **Fuel:** 15 percent nitro; 20 percent lube

Propeller	Combined rank	Ground rpm	Ground thrust	Air rpm loop/straight	% of Max./ air speed (mph) loop	% of Max./Air speed (mph) straight
APC 9.5x8N*	1	13,500	4 lb., 7 oz.	13,430/13,750	100%/43.5mph	100%/83.3mph
APC 9.5x8.5**	2	12,800	4 lb., 2 oz.	12,700/13,660	98.6%/42.9mph	99.4%/82.8mph
APC 10x8	3	11,500	4 lb., 9 oz.	11,130/11,460	93.6%/40.7mph	93.1%/78.0mph
APC 11x7	4	10,500	5 lb., 1 oz.	10,060/11,500	85%/37.0mph	94.5%/78.7mph
Rev-Up 11x7	5	10,200	4 lb., 8 oz.	9,780/11,750	87.1%/37.9mph	88.5%/73.7mph
Master Airscrew 11x7	6	9,300	4 lb., 8 oz.	9,000/10,830	83.9%/36.5mph	90.8%/75.6mph

*RAD—99.7; wet bulb—48 degrees Fahrenheit; dry bulb—58 degrees Fahrenheit; barometer—30 Hg.
**decibels at 9 feet—98. Wind speed—8 to 10mph

Breaking in ABC Engines

BREAK IN—ABC ENGINES

With so many different piston/cylinder combinations used for miniature aircraft engines, a great confusion exists concerning break-in procedures, fuels and lubricants. ABC (aluminum piston with brass chromed cylinder liner) engines are lapped-piston engines. They don't have piston rings and, therefore, rely on a very close fit between the piston and cylinder to prevent combustion gas blow-by at operational speeds and temperatures. The ABC concept was developed so the piston and cylinder could expand similarly from ambient to operational temperatures. Complications arise because the portion of the cylinder above the transfer and exhaust ports operates at a much higher temperature than the portion of the cylinder below these ports. This means that the upper portion of the cylinder expands more than the lower part. To compensate for this, the cylinder is machined to a taper—larger at the bottom than the top. The piston actually fits tightly in the upper portion of the cylinder when at room temperature. Because of this interference fit, the first few runs of a new ABC engine are critical to its future performance.

A typical ABC-type piston and cylinder. To deliver maximum performance, it must be broken in correctly.

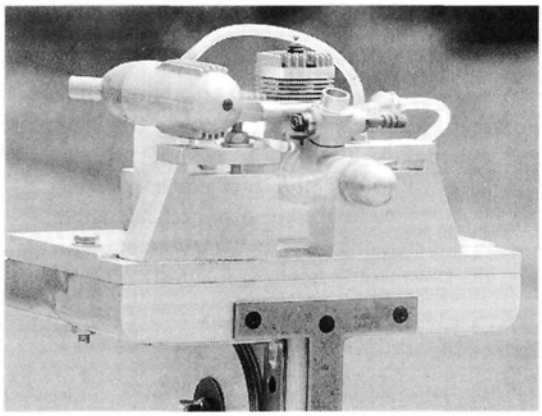
BENCH RUNNING FOR BREAK IN

All engines should be broken in (run in) on a test stand, where the operator can control the air/fuel mixture *instantly* by adjusting the primary needle valve. The problem with running in an engine in flight is that it's difficult to determine when it's running lean and hot. Even when you throttle back, the mixture may still be lean. Severe damage can and will occur from prolonged lean or undercooled operation. Save yourself the grief and expense; run your ABC engine on the test stand for a minimum of 45 minutes, 2 to 3 minutes at a time, with adequate cooling periods between runs.

BREAK IN AND FLYING FUEL

From the outset, decide on the fuel you're going to use for flying, and use that for break in. Just be certain there's enough oil content. Never run fuels with less than 20 percent oil. Competition racers sometimes experiment with percentages lower than 20 (18, 16, 14 percent and less have been used). The lower percentages reduce the *mass* of lubricant in the combustible air/fuel mixture, and this *may* improve the burning or flame propagation in the combustion chamber; this ultimately affects power output. These are minor performance gains, best left to the experimenter. Use lube percentages between 20 and 25, and your engine will stand a better chance of operating beyond a few flying sessions.

Use the nitro percentage for break in that you plan to fly with. Why? Generally, the more nitromethane a fuel contains, the higher the cylinder-head temperature will be. Higher cylinder-head temperatures mean greater expansion for the upper cylinder and, to some degree, the piston. If you break in an engine with 5-percent-nitro fuel, it will actually be *too loose* when 15-percent-nitro fuel is used because the cylinder expands faster than the piston as temperature increases.



Break in is important for all engines

CASTOR OIL

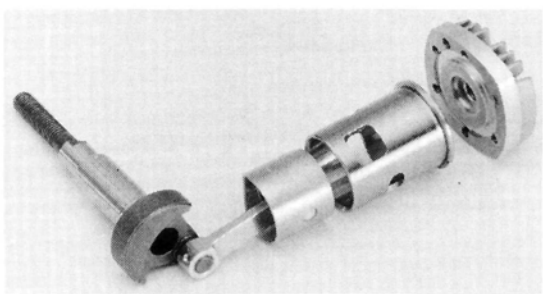
I always use castor oil in my fuels. Here's why: castor oil forms a protective varnish on the piston skirt and cylinder walls when it exceeds its breakdown temperature (somewhat above 500 degrees Fahrenheit, cylinder-head temperature). This varnish prevents metal-to-metal contact at the high temperatures. Again, the high temperatures are caused by a needle-valve setting that's too lean, or inadequate cooling, or both. Usually, an overheated, varnished engine will give you notice that something is wrong. The engine will slow or "sag" noticeably. Immediately shutting it down will generally prevent any damage to the cylinder. Synthetic lubricants also break down at about 500 degrees Fahrenheit, but they *don't* deposit a protective varnish. The metal-to-metal contact that results will destroy the piston and cylinder within seconds.

Why use synthetics? There are several

is for even greater specific power outputs and increased longevity.

MAGNUM PRO .36 SE DESIGN FEATURES

Besides utilizing ABN piston and cylinder technology, the Magnum also uses state-of-the-art Schnuerle with boost transfer porting. The crankshaft is supported by two ball bearings. The induction system is of the front rotary crankshaft variety with the forward-mounted throttle/carburetor. Important details, such as the connecting rod, are well provided for in terms of bushings and lubrication holes. The wristpin is retained by a wire clip and a protective Teflon pad. The front of the piston doesn't have a wristpin hole; it's blind-bored from the rear, providing a natural stop for the pin.



The state-of-the-art power train with squish band, hemispherical combustion-head chamber.

The cylinder head and backplate (rear cover) are provided with gaskets. The piston is of the baffleless variety, which allows an efficient squish band and hemispherical combustion chamber. The glow plug is of the long-reach variety.

The ultrasonic cleaning process failed to reveal any contamination such as metal chips or dirt. Aside from the ABC/ABN controversy, I was impressed with the product, the materials used and the quality of the machine work and fit. Thunder Tiger states that it recently brought many modern CNC (computerized

reasons. Besides having good film strength, synthetic lubes pass through the engine very cleanly, leaving little or no residue. I have a Webra* Speed .60 that hasn't been disassembled for cleaning in 12 years of operation. The piston is still bright and clean as observed from the exhaust side of the engine with the muffler removed. There's no varnish from being operated with totally synthetic lubricant. Just make certain you don't run lean or have poor cooling.

The bargain you make with castor oil is this: you must disassemble the engine occasionally and remove the varnish mechanically, using a mild abrasive and a stiff brush. (I use LAVA bar soap and an old toothbrush.)

You can usually tell when your engine is varnished; it won't hold a peak rpm setting; it will tend to "sag" (lose rpm); it will also overheat and become impossible to control with the needle valve. When the engine stops and cools off, the varnish solidifies immediately. It becomes difficult, if not impossible to "feel" when turning the engine over by hand; things seem normal. Don't be fooled. As soon as you restart, the increase in temperature will cause the varnish to liquefy, and your problems will recur.

2-STROKE VS. 4-STROKE OPERATION

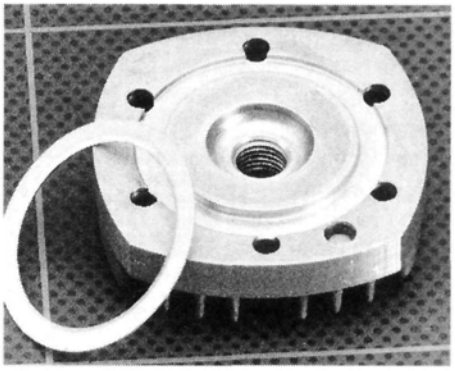
During break in, it's important to operate an ABC engine in a rich, 2-cycle mode. Don't allow it to *4-cycle*. For certain types of piston/cylinder combinations, i.e., iron piston/steel cylinder, this is preferred, but *not* for ABCs! If you operate your ABC 4-cycling, it will run exceptionally cool because the engine is only firing every other revolution, and the overly rich mixture is cooling the piston and cylinder. This cool condition allows the piston and cylinder to rub excessively because the cylinder doesn't expand enough to fully overcome the cold interference fit. The last thing you want to do is lose the tight piston fit.

VERY TIGHT ABC PISTON AND CYLINDERS

A special problem exists with some ABC engines when the cold fit is so tight that rapid wear is a real possibility when trying to start the new engine the first few times. I remember an instance when I requested a "really tight" ABC piston and cylinder from K&B's* Johnny Brodbeck. The replacement unit was for a 6.5cc front rotary-valve rear-exhaust engine for open pylon racing. When I tried to turn the engine over with the propeller, I couldn't do it! I thought I would break the rod or the crankpin. If you run in to a similar situation, simply heat the cylinder before trying to start the engine. I've used a heat gun (for film-type covering materials) to loosen the piston-to-cylinder fit. Only about 15 to 30 seconds of heat application are required to do the job. After the first few runs, the piston will naturally loosen to the point where external heat is no longer necessary. By the way, I still have that K&B, and it retains its "squeaky" fit after many hours of operation.

Finally, don't try to peak the needle for maximum rpm until the last 15 minutes of your 45-minute break-in period. The engine should be operated at a rich, 2-cycling level—occasionally leaning for a few seconds—and then back to rich. By the way, be sure to use a break-in propeller whose diameter is 1 inch less than that of the recommended flying prop. You don't want to overload (overwork) the engine during this critical phase of its life. For each engine, I keep a log of the break-in procedure, including run time, rpm and any special notes.

Wear your ear protectors, get out the lawn chair, and drive your neighbors nuts! (just kidding).



The cylinder head with aluminum gasket takes a long-reach glow plug.

Marvel Mystery Oil, paying close attention to the indicator marks for the front and rear of the head and rod. A nice touch is the alignment pin provided in the top of the crankcase for exact positioning of the cylinder sleeve; no more looking in the exhaust side of the crankcase and shifting the sleeve side to side until it "looks right."

BREAK IN

I know Thunder Tiger manufactured the engine, but I still don't agree with how they tell the buyer to break it in. In fact, there were so many things I consider incorrect, I've written a detailed description concerning ABC-*type* break-in procedures (see sidebar). You don't mind a bit of controversy once in a while, do you?

Magnum Pro instructions suggest:

1. Break-in propeller is the same size as the flight prop.
2. It's not necessary to give the engine a prolonged break in on the bench; do it in flight.
3. Use only castor-oil-based fuel. They later warn you against disassembling the engine: your two-year warranty will become void.
4. Dark stains on the piston are caused by breaking down *synthetic* lubricants in the fuel.
5. Strongly recommend using no more than 10 percent nitromethane for the break in.
6. Advise the operator to "open the needle valve...to allow the engine to run *very rich*. Allow it to run about 2 to 3 minutes in this condition."

numerical control) machines on line. They state, "Magnum now leads the hobby industry with the finest, most coveted assemblage of CNC equipment in the world." The quality of their work as demonstrated by the .36 tends to make me a believer.

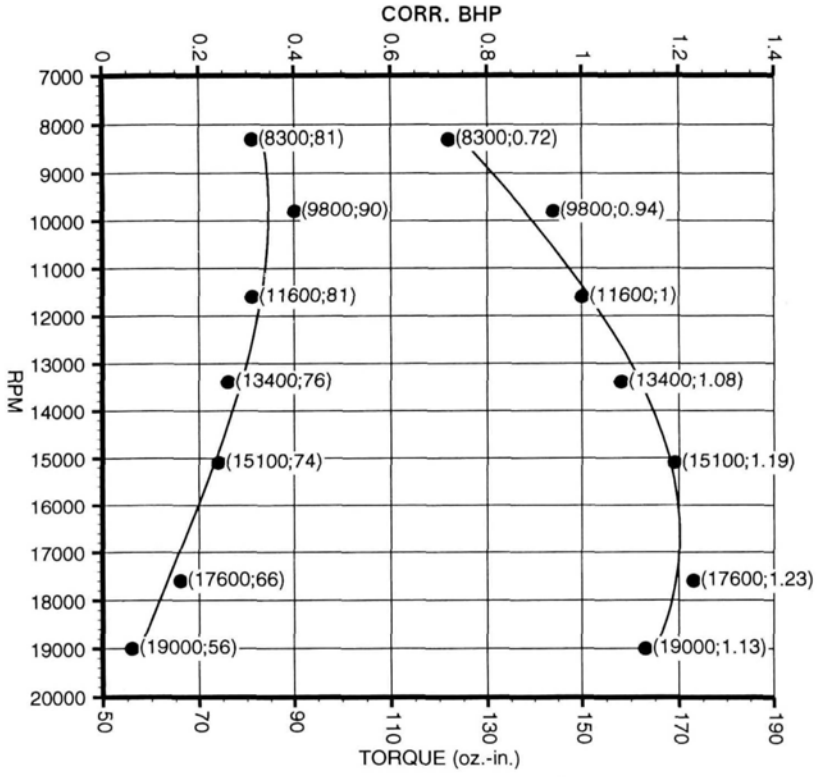
The Airtrax 40 weighed in at 5¾ pounds for flight tests; 4 ounces of ballast had to be added to the nose. The Magnum Pro .36 weighs only 11 ounces!

The Magnum Pro .36 is a decidedly over-square design, having a stroke-to-bore ratio of .85 to 1. This configuration lends itself well to high shaft speed operation while keeping peak piston speed in the reasonable category. The shaft thread is a USA user-friendly UNF ¼-28, while the all-up weight, including muffler, is only 11.4 ounces (313g).

The engine was reassembled using

RPM'S BREAK IN

I decided to use my old faithful fuel mix for the Pro .36, because that's what I would fly it with. The brew consists of 15



percent nitromethane, 20 percent lube (10 percent Klotz* KL-200 and 10 percent Bakers A-A degummed castor oil), and 65 percent methanol.

The castor oil provides a margin of safety against piston or cylinder damage if I ever run lean in the air for some reason (a speck of dirt in the spray bar?) and cylinder-head temperatures exceed the lube-breakdown temperature. Castor will save the day. Oh, sure, I might have to disassemble to de-varnish, but I probably won't have to buy an expensive new piston and cylinder set. Of course, this same fuel will be used for the dynamometer test.

The .36 was initially operated for 2 minutes at a rich 2-cycle at 10,000rpm. For the next 9 minutes, it was operated at 3-minute periods, always at the rich 2-cycling mode. The engine acted hot and required the cylinder-head screws to be tightened. I decided to reduce the prop load from the recommended 10x6 to a 9x6 Top Flite*. The lesser load allowed the engine to run cooler at higher rpm; it acted as if it welcomed the change.

After a half-hour, the engine was peaked. It held a steady 12,800rpm for 30 seconds. The noise level at this rpm was a not-so-quiet 98dB at 9 feet, on the exhaust side of the engine. An additional 15 minutes of 3-minute runs yielded a peak rpm of 13,200, and very steady. I was satisfied that the break-in was complete, plus the piston and cylinder still had a beautiful "squeaky" fit at top dead center (TDC).

DYNAMOMETER TEST

The engine was mounted to the torque reaction dyno and calibrated for accuracy. The first dyno test series with the .36 was conducted without a hitch using six load beams—until I noticed a loose glow plug on the last run. This necessitated a complete re-run, since I didn't know when the plug had loosened. The second set of numbers were better than the first, which suggests that the plug was loose from the beginning. Strange how well the engine needled, and the nice steady rpm and torque readings. Live and learn.

I'm looking forward to instrumenting the dyno for data retrieval. With the addition of forced-air cylinder cooling and cylinder-head temperature instrumentation (with exhaust-gas temperature measurement just down the road...) things are getting pretty complicated. I currently have a checklist for the items that demand attention for each load beam test: lock the torque arm; turn on the glow-plug heat; cooling fan; temperature meter; and tachometer; don't forget to erase the strike mark from the torque graph of the previous run. I've had trouble remembering to turn off the glow-plug heat once the engine has started. This compromises the run, which must be redone. The computer will help reduce the number of tasks I have to do, as well as the chance of error on my part.

Take a look at the corrected brake horsepower curve. At this point, it became apparent that this engine is very impressive. At 1.20-b.hp it has a specific output of 3.29b.hp per cubic inch displacement. This is accomplished on 15 percent nitro fuel and a very conservative venturi bore of .280 inch with a spray bar projecting into the air stream. I couldn't help but wonder what the Magnum Pro would produce if it were provided with a .350 venturi (approximately a 50 percent increase in bore area over stock), 40 percent nitro and a resonant chamber exhaust system. The point is, 1.2b.hp at 16,500rpm is tremendous for this conservative setup. The engine is docile in its handling characteristics; it runs smoothly with no bad habits.

Torque peaks at about 10,000rpm and 90 oz-in. I can remember when some hot-shot .60's couldn't generate 90 oz-in. of torque! Today's combination of induction, scavenging, combustion chambers, piston-cylinder materials and superb fits are producing engines of outstanding performance. This "little" .36 acts like a "big" .40 - it delivers excellent torque and turns large props at elevated rpm's. Look at the rpm's obtained for potential flight props as tested.

FLIGHT TESTS

The Airtrax* 40 test model weighed in at 5½ pounds, dry. I had to add 4 ounces of lead to the nose to achieve balance. At 5¾ pounds, I had some question as to how the little .36 might handle the load. The first takeoff answered my concerns quickly: no problem! The little job really scooted around the sky, to the surprise of several people at the field—especially when they learned it was only a .36.

Of the six props tested, you can see that the flight data indicated a clear-cut best

(Continued on page 128)

PRO MAGNUM .36

RPM	TORQUE	CORR. BHP	BHP	CORR. FACTOR	DISTANCE	Coefficient	51.1
						Wet Bulb (F)	74
8000						Dry Bulb (F)	78
8300	81	0.72	0.67	1.07	1.594	Bar Pres (Hg)	29.34
9800	90	0.94	0.88	1.07	1.763	Vap Pres (Hg)	0.77
11600	81	1.00	0.93	1.07	1.578		
13400	76	1.08	1.01	1.07	1.497		
15100	74	1.19	1.11	1.07	1.456		
17600	66	1.23	1.15	1.07	1.291		
19000	56	1.13	1.06	1.07	1.105		
19500							

Estimating Level Flight Speeds

by ANDY LENNON

FOR BOTH full-scale and model airplanes, good design practice requires that the angle of incidence at which the wing is set (on the drawing board) result in the lowest fuselage and horizontal tail drag at the aircraft's selected cruising speed.

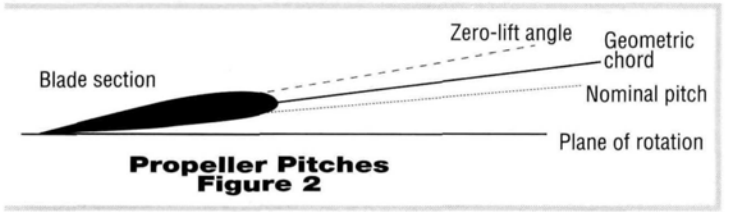
At lower speeds, the aircraft must nose-up, through elevator trim, to achieve the angle of attack that provides adequate lift. At higher speeds, the reverse takes place; down-elevator trim reduces the angle of attack.

To determine the wing's angle of incidence, the following data is needed:

- the wing's airfoil and its lift/drag curves;
- the aircraft's gross weight in ounces;
- the wing's area in square inches and;
- last, but not least, the selected level-flight speed in mph.

See the "Airfoil Selection" articles, Parts 1 and 2, in the May '92 and June '92 issues of *Model Airplane News*. Specifically, in the June issue, see:

- Formula 7—"Lift Coefficient Required";
- Special Procedure A—"lift coefficient per degree of angle of attack adjusted for aspect ratio and plan form";
- Special Procedure B—"angle of attack, or incidence, for level flight." These formulas require an estimate of the model's speed for completion.



Propeller Pitches
Figure 2

It is assumed that the lowest drag will occur when the model flies with its fuselage center line horizontal. The wing's angle of incidence, relative to that center line, will then be the same as the calculated angle of attack.

Figures 1A and 1B show the effect of too much incidence or too little. In both cases, fuselage and horizontal tail drag is higher.

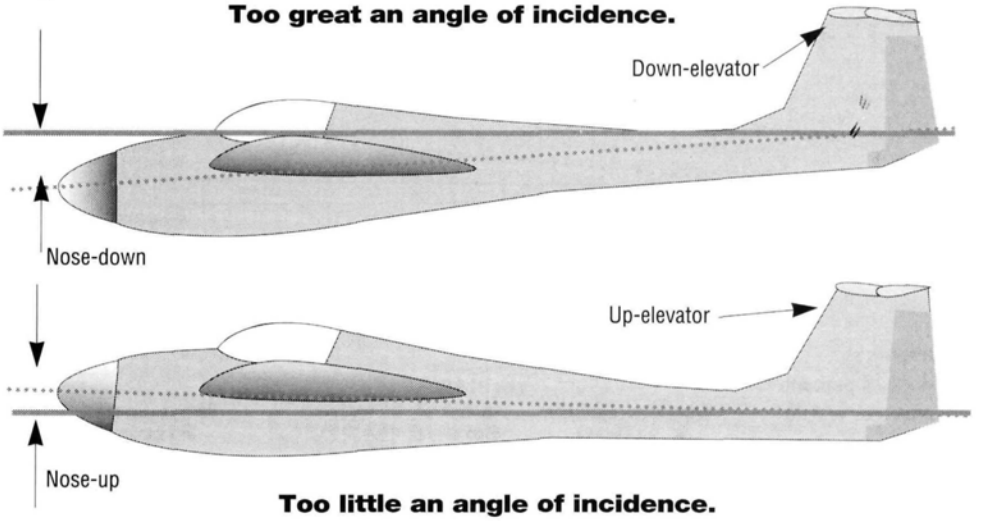
The problem is to estimate the model's level-flight cruising speed. Some chaps like to fly around the "pea patch" at maximum rpm and top speed; others, such as yours truly, are more conservative and enjoy flying at something less than top speed—say, 75 percent of the model's highest speed. Either way, evaluation of the aircraft's top speed is required.

Some years ago, a nomograph was developed for quickly determining a model's speed based on its engine's maximum static rpm and the nominal pitch of the propeller being rotated at those rpm. The nomograph was based on two assumptions:

- In top-speed flight, there would be a gain of 10 percent in rpm, since the prop is operating at a lower angle of attack, with less drag, than it would be if the model

Figure 1A

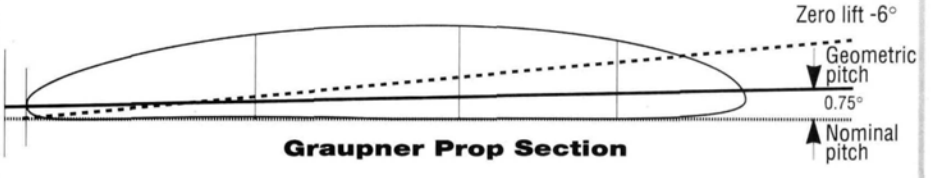
Too great an angle of incidence.



Too little an angle of incidence.

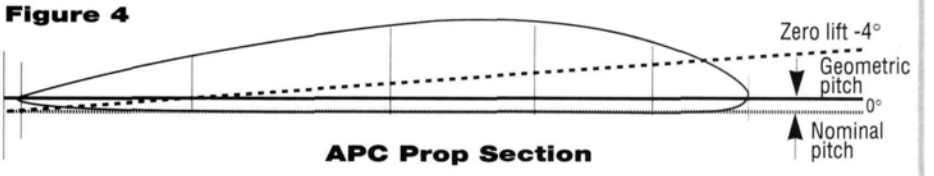
Figure 1B

Figure 3 **Propeller Airfoil Sections**



Graupner Prop Section

Figure 4



APC Prop Section

Figure 5 **Master Airscrew section**

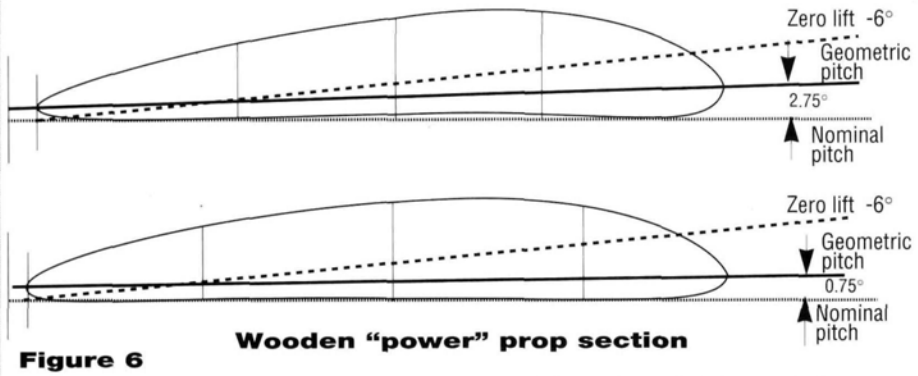


Figure 6 **Wooden "power" prop section**

was stationary.

• A loss of 15 percent in advance per revolution of the prop compared with the prop's nominal pitch advance.

This was incorrectly based on the oft-repeated statement that a prop/engine combination developed only 85 percent of the engine's output in terms of thrust.

DAVE GIERKE'S INITIATIVES

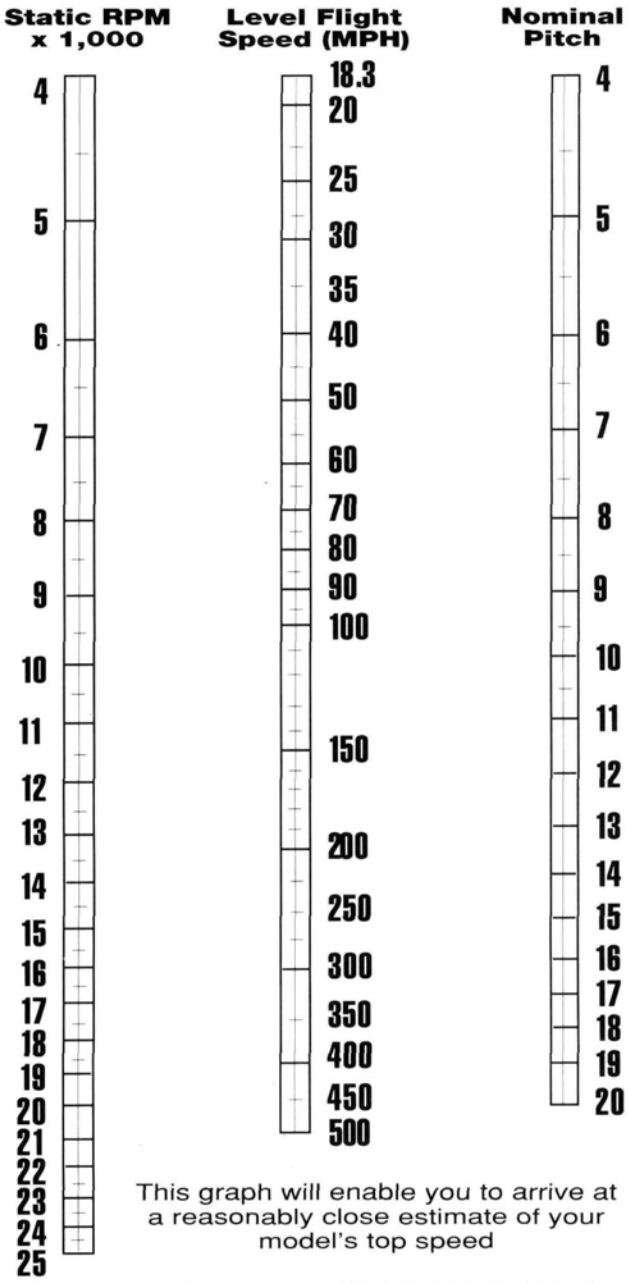
Dave Gierke's "Real Performance Measurement" (RPM) reports in *Model Airplane News* on engine and propeller performance are, in this writer's opinion, outstanding—a real breakthrough and a major contribution to model airplane design.

For each engine under study, he provides not only horsepower and torque curves and details of its construction and handling, but also static- and level-flight rpm and the model's actual air speed at those rpm. He uses a variety of prop makes, diameters and pitches that are suitable for the engine being evaluated.

• Knowing static and flight rpm allows you to evaluate the gain in revolutions in flight.

• Knowing in-flight speeds and rpm allows you to calculate the actual advance per revolution and compare it with the prop's "nominal" pitch advance.

Figure 7



This graph will enable you to arrive at a reasonably close estimate of your model's top speed

This calculation is:

$$\text{Advance per rev} = \frac{\text{speed (mph)} \times 5{,}280\ \text{(ft./mi.)} \times 12\ \text{(in./ft.)}}{\text{rpm} \times 60\ \text{(min./hr.)}}$$

Analysis of Dave's figures brought two facts to light:

• The assumption of a 10-percent gain in rpm from static to level flight was not too far off.

• The big surprise was that the advance per revolution exceeded the prop's nominal pitch anywhere from 7 to 18 percent.

Figure 2 is a prop blade section. For the actual advance per rev to exceed the nominal pitch advance, the blade's actual angle of attack must be somewhere between the "nominal pitch" and "zero-lift" angles. The nominal pitch is measured, with a pitch gauge, on the blade's rear surface, at a point that's 75 percent of the blade's length, measured from the prop's center. The blade's airfoil, the leading-edge radius and its position relative to the nominal pitch all have a bearing (see Figures 3, 4, 5, and 6).

The nomograph has been revised in Figure 7, and the range of pitches and rpm have been extended to reflect current conditions. The 10-percent gain in revs from static to level flight has been retained; but a 10-percent increase over the nominal pitch advance per rev replaces the 15-percent *loss* used in the original nomograph.

This graph will enable you to arrive at a reasonably close estimate of your model's top speed, based on the engine's static maximum rpm and its prop's nominal pitch.

These results will never be 100 percent accurate, since the model's weight and drag will have an unavoidable impact, but they are close enough for all practical purposes.

Align a straightedge from rpm, left, to prop nominal pitch, right. The speed in mph is read off the center scale. See also "Propeller Selection," Parts 1 and 2, in the November '92 and December '92 issues of *Model Airplane News*.

Congratulations, Dave Gierke, and keep up the excellent work.

**Here are the addresses of the companies mentioned in this article:*
Graupner; *distributed by Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027.*
APC Props/Landing Products, *P.O. Box 938, Knights Landing, CA 95645.*
Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.* ■

'93

NATIONAL COMPETITION

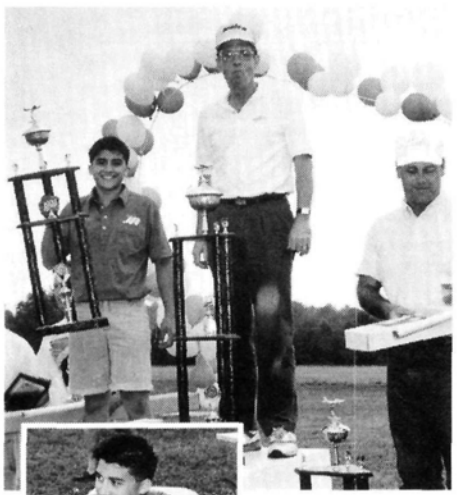
Fun Fly Nationals

by BOB GILBERT

PHOTOS BY BOB GILBERT

Typical takeoffs of Unlimited fun-fly designs are vertical with power to spare!

The winners of the Formula Expert event (left to right): Mac Hodges—second place, James Barr—first place, Jerry L. Smith—third place.



Top: the winners of the Unlimited Expert event (left to right): Jeff Gilbert Jr.—second place, Jerry L. Smith—first place, David Halverson—third place. Left: Jeff Gilbert Jr. does a little tweaking on his Webra .32-powered model. Jeff placed second in the Unlimited Class.

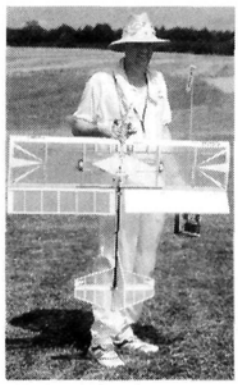
Proving grounds for the latest in design development

THE '93 COMPETITION Fun Fly Association (NCFFA) Nats was held in Youngsville, NC. The two-day event, which was colorful and diverse, was cohosted by the Raleigh Aeromasters and Hobbies Etc. of Raleigh, NC. The event directors, Robert Vess, Don Asplen and Gary Harris, were ably assisted by the club members in making this Nats one to remember. Thirty-four pilots from across the country and Canada came to compete in Unlimited Expert and Unlimited Formula Classes and for the *Model Airplane News* Technical Achievement Award. This was one of the best fun flies that I have ever attended, and one where pilots learned a lot about models that were designed to win.

THE PLANES

Keeping track of the latest technical advances in this corner of the R/C airplane hobby is a major task. Here are a few of the trends I noticed at the Fun Fly Nats:

- Light airplanes always seem to fly much better in Unlimited events; however, there's a tradeoff in strength.
- Triangular airfoils and very thick airfoils were common.
- The mufflers, which had been flopping around in the breeze for years, are now all properly anchored. The now common "mousse-can" muffler quiets the 32-size engines, so they can be used at flying fields that limit sound.
- The Unlimited Expert fliers settled on one prop size and pitch; the top nine all used a Rev-Up* 10x4 prop.
- Reinforcing the wing spars with carbon fiber was almost universal.
- During the contest, many fliers used 25- and 30-percent-nitro fuel to provide that little extra punch.

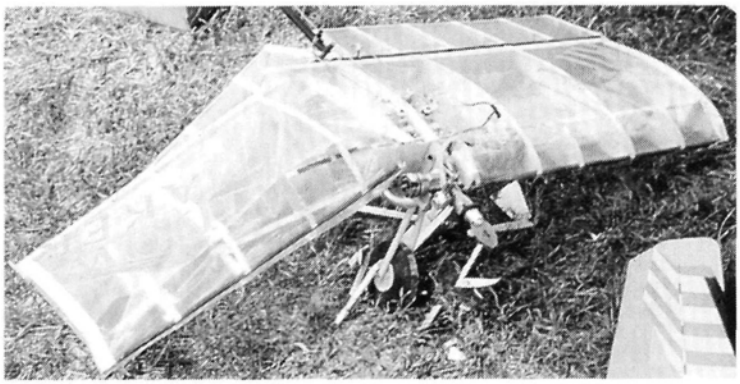


Jerry L. Smith of Paducah, KY, placed first in the Unlimited Class.

NEW TWISTS

Full flying elevators were common (no horizontal stab), and in most of the models, the engine, landing gear and forward fuselage were incorporated in a single compact unit, often using a piece of molded, fiberglass-filled plastic.

Every pilot in Unlimited used a computer radio. "Simple Programming" columnist Dave Baron used his radio to full advantage by mixing his rudder command into the



Azarr's Widowmaker after an unfortunate crash. Many say that Azarr's designs out-perform his talents as a pilot. And he's a good pilot!

ailerons. These were set up to give independent spoiler action when the rudder stick was operated. Because fun-fly models often don't have rudders, Dave's setup provided the model with good yaw without a rudder. This allowed him to keep the wings level during loops.

The youngest entrant, Jay Kabala, with Miss Martha a/c.

FORMULA EVENTS

Faster, more powerful planes flew in the Formula events. Formula planes are required to have servos that are enclosed in the fuselage, and wing-loading requirements must be met. Engines of up to .51 size participated, but the first place went to an O.S.* 46 FS in James Barr's design, the "Barr None." Jerry L. Smith's Spark had wedge-shaped wingtips, which he claims give lower drag when in the tight maneuvers. These planes were blindingly fast, and they used up a lot of airspace.

RECORD-BREAKING

Only hundredths of a second separated the top finishers. The times were converted to scores and computerized, using a program that was developed by a club member.

Jerry L. Smith set a record for doing five roops (a roll followed by a loop) in 8.48 seconds. Wynn Aker managed a modified Dixie Death (a takeoff, three loops, three rolls and touchdown) in 13.18 seconds.

Other Unlimited events included 10 Outside Loops and 10 Loop Touch and Go's. The best times for these were 13.52 and 15.89 seconds.

Special models at this Nats included Ernest Johnson's Cessna, which had an onboard fuel indicator. When the fuel was low, a streamer was released behind the plane. Jerry L. Smith flew a very fast "Fast" (that's the name of the plane) flying wing, and Anthony Wiencek's Aggressor was clocked at 187mph. Other R/C models included Jeff Foley's A6M2 Zero, David Hayes' Rockwell Thrush, Steve Pierce's MAS Excel Helicopter, Aerotech's* Interceptors, Jay Kabala's Extra 300, Jeff Gilbert Sr.'s Diamond Dust Wing by GAPP* and various planes from the Florio Flyer Corporation*.

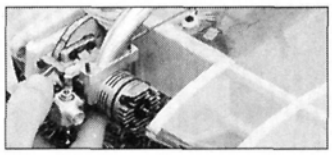
AWARDS

Thanks to the efforts of the organizing club and the supporting sponsors, trophies and merchandise were awarded through 10th place in both Formula and Unlimited. The Aeromasters erected a winners' platform with three steps, and photographs were taken underneath a rainbow of colored balloons.

The Unlimited national champion for the third year in a row is—you guessed it—Jerry L. Smith. He flew his own design, which incorporates an airfoil by Robert Vess. Power was supplied by the now popular Webra* 32; his plane was controlled by Futaba* 9ZAP. Jeff Gilbert Jr. flew his diamond airfoil Li'l Rippy to second place using a Webra 32, also. Despite having driven all night

TECHNICAL ACHIEVEMENT AWARD

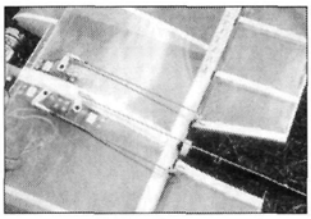
The pilots were almost unanimous in their selection of Azarr's Widowmaker for this award. Here's why.



The Widowmaker's engine is recessed into the wing.

Azarr used carbon fiber to strengthen the wing spar, and he also used a carbon-fiber arrow shaft for the leading edge of the wing. A balloon was used for a tank, but without pressure. The Widowmaker weighed almost 2 pounds.

To provide a very short nose moment, which helps the plane to make tighter, faster loops, the crankcase of the Enya engine was recessed into the wing. Azarr used a small carbon-fiber arrow shaft for the aileron leading edge and a 1/16x3/8-inch strip for the trailing edge. He added short sections of the 1/16x3/8 between these strips (similar to shear webbing on a wing spar). This made a very light aileron structure with substantially more torsional rigidity than any design I've ever seen.



Left: the underside of Azarr's Widowmaker shows his unique ribless aileron construction. Right: Azarr (left), the recipient of the "Model Airplane News" Technical Achievement Award and Robert Vess, co-director.

This allows the servo and the control arm to be placed near the center of the airplane. Positioning the servos (which have a comparatively large mass) near the center line reduces the momentum that's required to rotate the airplane during rolls. This system also keeps the heavier parts closer to the CG. In many ways, this is a design that will be copied in the future.

WINNERS' TABLE

UNLIMITED EXPERT

Pos.	Pilot	Aircraft	Designer(s)	Radio	Engine	Prop	Fuel
1	Jerry L. Smith, KY	Smith Sup. Special	J.L. Smith/Vess airfoil	Fut 9ZAP	Webra 32	Rev 10-4	Blue Thunder, 30 percent
2	Jeffrey Gilbert, Jr., MI	Li'l Rippy	Gilbert	JRX-388	Webra 32	Rev 10-4	Powermaster
3	David Halverson, NJ	Hang Gilder 4	Halverson	Fut 7UAPS	Webra 32	Rev 10-4	Omega, 25 percent

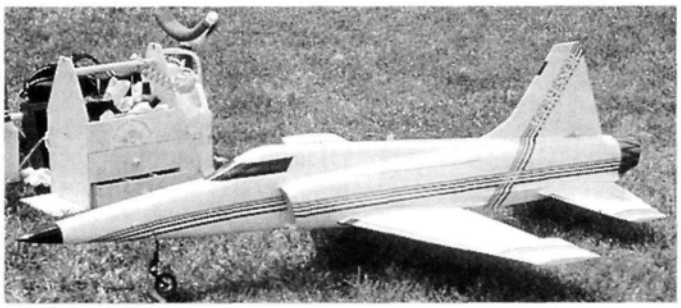
FORMULA EXPERT

Pos.	Pilot	Aircraft	Designer(s)	Radio	Engine	Prop	Fuel
1	James Barr, SC	Barr None	Barr	JR PCM10	O.S. 46SF-P	APC 10-7	Omega, 30 percent
2	Mac Hodges, GA	Bigun Batt	Batt/J.R. Smith	JRX-388S	ST 51	MA 10-6	Omega, 15 percent
3	Jerry L. Smith, KY	Spark	Vess	Fut 9ZAP	Webra 50	Rev 11-4	Byron, 15 percent

from New Jersey, David Halverson put in a great performance and placed third with his Hang Glider, which also used Webra and Futaba equipment.

The new Formula national champion is James Barr, of Liberty, SC, who displayed unusual fortitude when it came to staying in the competition. At a 7 a.m. practice session, James cut his left arm and had to go to the hospital. He returned to win the Formula Expert event.

Jim Florio (holding the model) helps contestant Rich Hook get going for another round of roops. The model is a modified Coal Hauler.



The fastest model at the meet: this BVM Aggressor ducted fan was clocked at 187mph!

Mac Hodges won the second spot in the Formula Class using a SuperTigre* .51 in a Bigun Batt. He also placed 11th in Unlimited. Great flying! Jerry L. Smith also won a trophy by placing third in Formula. He flew a fast, sensitive Spark airplane that was powered by a Webra 50.

All of the registered pilots voted for the winner of the Technical Achievement Award. *Model Airplane News* presented a huge plaque, along with $200 cash, to Azarr, from Ohio. In accepting the award, Azarr announced that $100 would be given to the NCFFA to "Keep up the good work!"

Jeff Gilbert Sr. and new, very fast Diamond Dust delta wing get ready for a demo flight.

The Highest Placing Young Flier award—an Airtronics* Infinity 600A radio—went to Jay Kabala.

The Raleigh Aeromasters did a great job of spicing up the flying. On Saturday morning, two full-size Wilgas flew in and landed on the 300-foot-long paved club runway. A home-built Kitfox and a helicopter stayed all weekend to give rides. A PT-17 Stearman bipe also made a couple of low, slow passes over the field.

CONCLUSION

I want to thank everyone who helped to make this such a wonderful event. If you've never been to a competition fun fly, I urge you to go. You'll be amazed by these machines, and you'll learn a lot. Also, keep an eye on the Formula events. They're just getting started, but because they use a more standard airplane, I predict that they'll grow in popularity.

**Here are the addresses of the companies mentioned in this article:*

Rev-Up; *distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.*

O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

GAPP, *123 Goodrich, Zeeland, MI 49464.*

Aerotech R/C Models, *1094 Old Clubhouse Rd., Virginia Beach, VA 23456.*

Florio Flyer Corp., *P.O. Box 88, 149 Scotland St., Dagus Mines, PA 15831.*

Webra; *distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*

SuperTigre/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*

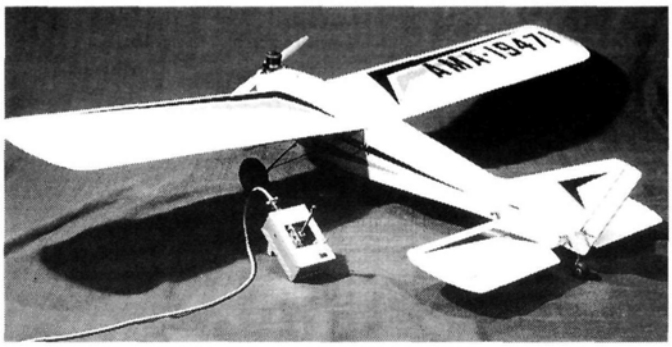
Airtronics Inc., *11 Autry, Irvine, CA 92718.*

GOLDEN AGE OF R/C

HAL DeBOLT

ANALOG PROPO CONTROL AND THE '57 NATS

IN THE PAST, I've noted how the modeling magazines were instrumental in helping R/C progress by featuring design and construction articles for R/C systems. As R/C'ers delved into the mysteries of electronics, breakthroughs occurred almost monthly, and editors such as Howard McEntee, Ed Lorenz and Walt Schroder presented eagerly awaited findings. Owing to the lack of desirable commercial equipment, many modelers took the long road and built their own. They enjoyed it, too!



Don Dickerson's Yellowbird—a 1963 Nats winner—used B&D Pulsatone proportional and K&B 45 power. Note the hand-held control box.

ANALOG PROPO CONTROL

Some time ago, Don Dickerson of Florissant, MO, provided extensive info on his and Norman Beeler's B&D Pulsatone system, which *Model Airplane News* featured in a construction series in '63 and '64. According to Don, hundreds of the systems were built, and many were successful. I've been waiting for an opportune time to discuss Don's fine work in detail.

Don Dickerson today with his OT'er: a much-flown Taurus.

In the early '60s, Don and Norman were engineers at McDonnell Douglas in St. Louis. They were members of the company's R/C club, and as they attempted to progress from single channel to multi via the Good TTPW system, they thought that there should be a simpler way to accomplish the task. (Systems such as Space Control, Sampey, Quadraplex, etc., hadn't surfaced yet, and digital control was still years away.) Somehow, Norman acquired a rudimentary feedback servo (the style that's used today), and he and Don saw its potential. They developed a 3-channel analog system that featured the propo feedback concept.

It was designed to provide the necessary variable input to the two propo-feedback servos. The throttle was controlled by a simple "trimmable" servo that would move as long as it was fed current. Because it was an audio system, this channel feature was gleaned from the single-channel pulse types.

The proportional controls were obtained by varying the rate at which the audio frequency was switched on and off. A 32 to 48Hz variable rate controlled one channel, and the second was controlled by varying the ratio of tone "on to off" time from 30 to 70 percent. The basic B&D system was published in the '63 issues of *Model Airplane News*.

Norman subsequently added a third prop channel by varying the audio frequency (à la Space Control and Sampey). Essentially, he and Don adapted a Sampey tone discriminator to the B&D and published the modification in the '64 issues of *Model Airplane News*.

It's interesting to know how this material was published. As R/C'ers, Don and Norman wanted to fly their creation; in those days, the first flight of your "dream" (and the considerable effort involved) was the climax of it all. Fortunately, they had flight-proven shoulder-wing models to use; the control arrangement was coupled aileron-rudder, elevator and engine. The system performed far beyond their expectations. They were ecstatic! They wanted to share their discovery.

ANALOG AT THE NATS

At the 1962 Nats, there were still three R/C classes. Although Class 2 allowed unlimited controls, they had to be operated by a "Mickey Mouse" system—

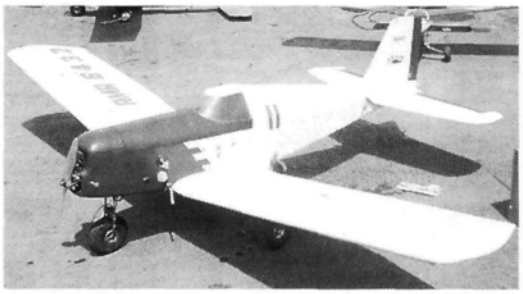
Doug Spreng starts a '64 Nats flight. The flat-top Stormer was a popular design, and the Lee .45 engine was a jewel!

THE '57 NATS

Walt Good does his thing with his perennial TTPW-equipped Multi-Bug.

John Shannonhouse of Forest Park, GA, provided these fine photos. This was John's first Nats, which he attended with his friend Al Pinson.

The '57 Nats was an R/C milestone that marked the turning point away from early R/C to what we have today. As it had been previously, this Nats was dominated by cabin-style designs, but one biplane and one low-wing were present. The bipe came within half a point of upsetting the apple cart by taking it all, and although the low-wing didn't win anything, it foretold the future. The '58 Nats saw the arrival of the low-wings, and the cabin designs were soon relegated to trainer status.



A taste of things to come: a neat low-wing with trike gear and all!

Here's master modeler Keith Storey with his winning Bonzo pylon racer.

My Custom bipe finally comes into its own.

Pylon racing was in its infancy; this was Lou Andrew's entry in the "one at a time" event.

one that had interaction between the controls. At that point in its development, the B&D had a slight twitch (which was later refined out), so it was eligible for the Class 2 event.

Don recalls that during his first two attempts, the engine failed prematurely. Fortunately, the problem disappeared on the third flight, and Don's score was on a par with many of the Class 3 entries, and it easily won Class 2.

At that time, genial Walt Schroder was the editor of *Model Airplane News*, and he was very impressed by Don's accomplishment. Walt offered to publish the plans for Don's model, but Don and Norm convinced him that the system was far more significant. The widely acclaimed series was the result.

Don's efforts didn't end with the *Model Airplane News* version. During the second time around, he revised the discriminator circuit. This was simpler, it reduced weight and was more compact. Later, a superhet front end was incorporated, and the single relay was eliminated. By this time, however, digital had arrived, and analog propo was relegated to history.

Don wrote this outstanding description of his and Norman's role in the early development of R/C:

"In retrospect, the B&D Pulsatone was a transitional concept that provided the needed improvement over other pulse systems, such as TTPW. It allowed those of us who didn't believe in 'reeds' to fly true feedback propo when commercial systems weren't available. Yes, we brazenly adapted ideas from others, but, in turn, we developed significant improvements and circuitry of our own. All things considered, developing the B&D system and publishing the articles was a highlight of my modeling career and the most fun I've ever had during it. And, I believe Norman—'the visionary'—would also agree!"

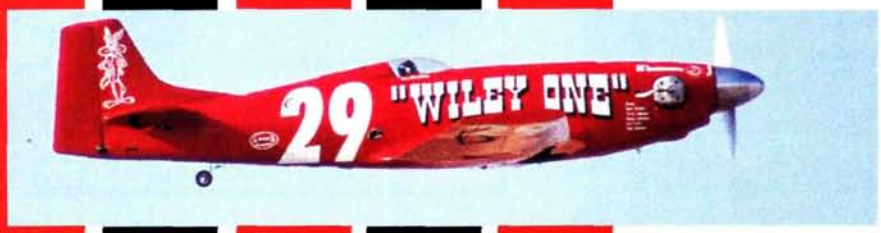
Don has retired but is still active as the president of the McDonnell Douglas R/C club. He says that he doesn't yearn for the "old days," when the marginal equipment was likely to eat your cherished model. He does, however, keep a few early systems flying just to show newcomers how it used to be. His favorite is a Midwest Whizz Kid that's guided by an Ace Commander single-channel pulse transmitter with a Testors receiver (of all things) and an Adams actuator. He tells us that the OT'er is as reliable as our modern stuff and that its magnetic actuators are the finest he has seen (for single-channel pulse, of course).

Don tells us that Norman moved to Lockheed, CA, where he gave up modeling to become a full-scale flight instructor.

This is a fine tale of two modelers who saw a problem and diligently worked to perfect the solution. Early R/C was a spawning ground for such efforts. I'll have more on Don Dickerson another time; meanwhile, remember that this is *your* OT R/C place! ■

Fred French's beautiful AT-6 takes the checkered flag in round 46. Fred took the trophy for most points earned in GSARA races for 1993.

Duke Crow's 46.7lb. Stiletto took third-place Silver with an Aerrow 200 opposed twin and fixed gear. (Just kidding about the gear. Duke has a perennial problem with retracts. We love ya, Duke; never change!)



Sandbagging could have helped Dave Johnson's "Wiley One." The 3W 120-powered Stiletto was just a hair faster than Dave and pilot Jeff Nickerson had predicted. Both of their airplanes ended up in the Gold with only one pilot to fly them. Every time race 29 and race 817 were scheduled to race in the same heat, no. 29 sat it out and earned a zero.

Don Rice skillfully touches down during qualifying. Expected to be a major threat this year, the 45lb. 1992 Madera champion was destroyed in round 28 when heat from its internal tuned pipe caused radio failure.

Mike Helsel took second-place Silver and a check for $700. (Saxton kit; 31lb.; for Brown Boys Racing.)

MADERA

UNLIMITED RACES

by ROB WOOD

PHOTOS BY TOM ATWOOD, ROB WOOD & DAN PARSONS

THE THIRD ANNUAL Madera races were held on October 6 through 10 at the Municipal Airport in Madera, CA. Seventy-six unlimited and 87 AT-6 Texan aircraft competed for a total purse of $15,350. According to Lesley Burnett, co-promoter of the races, the numbers this year were two to four times higher than last year, with 350 motor homes, 8,500 estimated spectators, 200 paid registration fees and approximately twice as many vendors as at previous races. There's no longer any doubt that giant-scale racing has established itself as the premier R/C sporting event, with four events held in '93 and four scheduled for '94.

Thanks to Pacer Technology (manufacturer of Zap adhesives) and *Model Airplane News*, who were primary sponsors; to Don Nix of Powermaster Fuels (he supplied all AT-6 fuel); to Fred Burgdorf of Landing Products (who timed aircraft speeds with a radar gun and supplied 22x10 APC propellers for all AT-6 races); and to the host of other contributors who helped make these races possible (see sponsor box at end).

A couple of very happy guys! Klaus Novak of Aerrow Inc. congratulates Kent McKenna on winning the Gold Trophy Race. Kent's racer was one of five Aerrow 200-powered trophy winners.

First Place Gold

Grand champion Lancair (race 45) and its Aerrow 200 powerhouse; 198cc twin develops 17+hp, swings a Zinger 21x22 prop at 8,400rpm static, with an acoustical tach reading of 10,000rpm in the air; Chevron premium unleaded with Power Plus go-kart oil, in a 32-1 mixture, with a Metalon additive. This engine was broken in with 10 hours of bench running.

'93 GIANT SCALE RACES DRAW RECORD NUMBERS

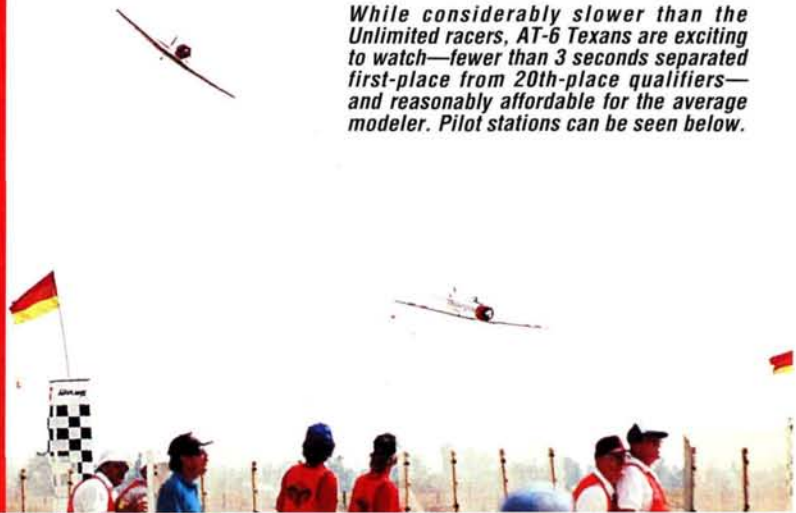
An aerial shot from Dan Gray's Pitts reveals the huge size of the event. The RV park that sprang up overnight was the size of a small city, and hundreds more stayed at nearby hotels.

John Lockwood, well-known aerobatic champion on the IMAC circuit, made his racing debut at Madera '93; 41lb. Saxton Mustang took first-place Bronze with an Aerrow 200 RS for power; propped with a Zinger 24x20.

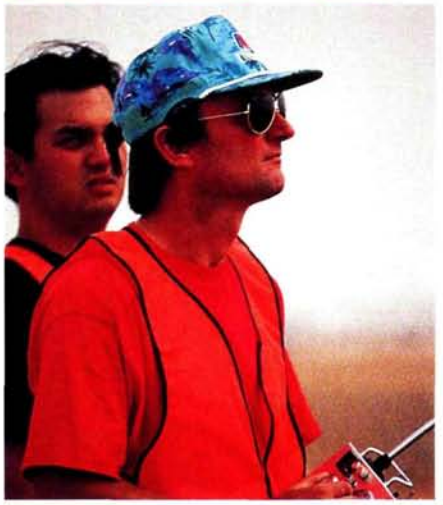
Light weight, a strong engine and custom-made props helped Dan Gray take first-place Silver with race 196BL; 27lb. Stiletto was built from a D&W Aircraft fiberglass-and-foam kit; 3W 120 twin; wood and carbon-fiber prop.

A study in streamlining, Kent McKenna's 40lb. Lancair was top qualifier and grand champion in Unlimited. Fiberglass fuselage is reinforced with honeycomb, sports Divinecell bulkheads and formers, and end-grain carbon-fiber/basswood firewall. Aerrow 200 RS engine is mounted on a 4130 welded-tube steel framework by John Krohn. Wings are constructed of 1lb. foam-core, 1/16 in. balsa skins; end grain balsa/carbon-fiber spar, wrapped with Kevlar thread; carbon-fiber spar caps; Gene Barton retracts; kits are available from KT Aviation.

While considerably slower than the Unlimited racers, AT-6 Texans are exciting to watch—fewer than 3 seconds separated first-place from 20th-place qualifiers—and reasonably affordable for the average modeler. Pilot stations can be seen below.



MADERA



Evenly matched AT-6 Texans tend to occupy the same space at the same time. Early in the heat races, one lived and one died.

Left: Dan Gray continued a winning streak that began with a first-place Gold trophy at Reno '93. Dan uses a single-stick Futaba transmitter and took fifth-place Gold and first-place Silver at Madera '93.

Balsa and ply are still competitive building materials: 51lb. Seafury won second-place Gold and Best of Show! Built by John Krohn from Roy Vaillancourt plans, "Miss Merced" sports an Aerrow 200RS engine and Likes Line retracts; flown by Mike Helsel.

A 3-minute window seems more like 3 seconds out on the flight line. Diego Lopez flew 40lb. KT Aviation Strega to a fourth-place Bronze finish. Bill Van Leeuwen's 4-cylinder, 4-stroke custom engine was one of two that did well at this year's races.

Giant-scale racing is becoming a truly professional sport, as experience, dependable engines and strong airframes begin to tell. Pylon turn lights were brighter this year (see below).

Venerable race 84 goes out in a blaze of, well, not glory, exactly. Bryan Keil flew the 31lb. racer to victory in the Medallion class and won for Classical Racing Team a bottle of warm white wine. Scratch-built from Ziroli plans, the 84in. fuselage is 3 in. too short to qualify in future GSARA races. Race 84 won second-place Silver at Madera '93 and second-place Gold at Reno '93.

Excellent piloting and an Aerrow 200 engine overcame the excess weight of second-place Silver winner, race 28. David Smith made his debut on the race circuit on the sticks of this 50.65lb. Sky Aviation Stiletto.

MADERA

This year's competition introduced two new aircraft to the field, and both won gold trophies. Kent McKenna, flying a KT Aviation* Lancair (pronounced "lance-air"), smoked the pack, winning every heat race he flew. Kent's airplane was modeled after a civilian aircraft that attempted to qualify in 1991 and was called to race from the 1992 Medallion class at Reno. Although the full-scale Lancair was too slow to compete seriously at Reno, the model, with its high-aspect-ratio wings and teardrop fuselage, was the aircraft to beat at Madera. The Lancair radar-gun readings registered over 170mph!

"I believe he was going closer to 190mph," said Fred Burgdorf, radar-gun operator. "My radar gun couldn't read a speed over about 172mph on the Lancair because of the shape of the airplane." The highest radar reading at Madera, however, goes to Chip Hyde, whose Precision Eagle Triple-powered Mustang was clocked in at 175mph.

The second aircraft to make its debut at Madera was the Vendetta, which was modeled after a full-scale Reno racer that sported a Mustang fuselage and Learjet wings and stab. Flown by Jeff Nickerson for Desert Aircraft*, the 35-pound model was a top contender for the gold, finishing a respectable third in the trophy race.

THE NAME OF THE GAME IS SPEED

The top speed at Madera this year was considerably under the 200+mph reported here and there around the country prior to the races. On investigation, none of the claims was substantiated, although Bill Cunningham reported a radar reading of 200+ downwind in a steep dive. In a race, the only speed that matters, however, is relative speed, which is computed by factoring in the total course length and the time it takes to compete six laps. A comparison of the two previous Madera races with statistics from Madera '93 yields some interesting data. Although no course times or relative speeds are available for this year's trophy races, some conclusions can be drawn from the posted qualifying times and relative speeds:

1. '93 Fastest Unlimited Qualifier: Kent McKenna, 154.07mph
2. '92 Gold Trophy Winner: Don

Madera '93 was an international event. Norbert Gruntjens (Germany, first-place Silver, AT-6) and Alain Trapier (France) were sponsored by MAC's products, RacePro Products and R/C Country. Here's the team (left to right): Joel Leonard, Howard Baldwin, Gary Rasher, Rodger Grotheer, Mark Fiorello, Alain Trapier, Van Scyoc, Ed Sutter, Joe Marine and Norbert Gruntjens.

Unlimited Gold

Pos.	Team/Pilot	Race no.	Aircraft/kit	Wt.(wet)	Engine/disp.	Fuel	Radio	Prop	Prize
1	M&K Racing/Kent McKenna	45	Lancair IV/K.T. Aviation	40 lbs.	Aerrow 200RS/198cc	Gas	Futaba.	Zinger 22x20	$2,000
2	**M&K Racing/Mike Helsel**	**87**	**Sea Fury/Ziroli**	**51 lbs.**	**Aerrow 200RS/198cc**	**Gas**	**Futaba.**	**Larson 22x20**	**$1,500**
3*	Desert Aircraft/Jeff Nickerson	817	Vendetta/Desert Aircraft	35 lbs.	3W/120cc	Gas	Airtronics	Glasner 20x24	$1,200
4	**Braun Racing Team/Don Albright**	**855**	**P-51/scratch**	**39.6 lbs.**	**Precision Eagle/8.4ci**	**Byron**	**—**	**APC 24x18**	**—**
5	Aviation FX/Dan Gray	196	Stiletto/Custom	27 lbs.	3W/120cc	Gas	Futaba	Custom 22x?24	—

Unlimited Silver

1	Aviation FX/Dan Gray	196BL	Stiletto/Custom	27 lbs.	3W/120cc	Gas	Futaba	Custom 22x 24	$1,100
2	**RWR/David Smith**	**28**	**Stiletto/Sky Aviation**	**50.65 lbs.**	**Aerrow 200S/198cc**	**Gas**	**JR**	**Bolly 22x25**	**$900**
3	RWR/Duke Crow	70	Stiletto/Sky Aviation	46.7 lbs.	Aerrow 200RS/198cc	Gas	JR	Custom 22x22	$800
4	**Braun Racing/Stinger Wallace**	**47**	**P-51/Sky Aviation**	**44 lbs.**	**Precision Eagle/8.4ci**	**Alcohol**	**Futaba**	**APC 24x18**	**—**
5	Horndog/Bubba Spivey	009	Stiletto/Sky Aviation	42 lbs.	James George/7.4ci	Alcohol	Futaba	Bolly 22x20	—

Unlimited Bronze

1**	AT&E Enterprises/John Lockwood	811	P-51/Saxton	41 lbs.	Aerrow 200/198cc	Gas	Futaba	Zinger 24x20	$700
2	**Hobby Barn Racing/Bill Hempel Jr.**	**851**	**Stiletto/Hobby Barn**	**28 lbs.**	**Twin Moki/3.6ci**	**Alcohol**	**Futaba**	**APC 16x16**	**$550**
3	Hans Lieberman Racing/Cliff Adams	2	Stiletto/Custom	32 lbs.	4-cyl/4-stroke Custom/6ci	Glow	JR	Clarke 21x16	$400
4	**4-Stroke Racing/Diego Lopez**	**3**	**Strega/KT Aviation**	**40 lbs.**	**4-cyl/4-stroke Custom/100cc**	**Byron**	**Futaba**	**Zinger 22x20**	
5	Horndog/Wayne Voyles	02	Stiletto/Sky Aviation	40 lbs.	James George/7.4ci	Alcohol	Futaba	APC 22x20	—

Medallion

1	Classical Racing/Bryan Keil	84	Stiletto/Ziroli plans	31 lbs.	Webra/4.4ci	Alcohol	JR	APC 22x16	Bottle wine.

Best of Show: Unlimited

	M&K Racing/John Krohn	**87**	**Seafury/Ziroli plans**	**51 lbs.**	**Aerrow 200RS/198cc**	**Gas**	**Futaba.**	**Larson 22x20**	**$250**

*Flew as alternate when 007 failed to start **Flew as alternate when 88 crashed on takeoff.
The lion's share of the spinners for AT-6 Texans and Unlimiteds were manufactured by Tru-Turn, while the overwhelming majority of retracts were by Robart.

MADERA

Janine Walker of Robart walks Tom Walker's race no. 20 out to the flight line in the AT-6 races. (Tom is second from right in the pilot stations.) Robart landing gear were widely used at the races, and Robart offered support in the pits. At far left is Cal Orr, flight-line director.

Rice, 151.32mph
3. '91 Gold Trophy Winner: Bill Hempel Jr., 152.33mph

Although speeds for the top Unlimited racers were essentially the same at all three races, the overall speeds of the top 30 airplanes this year were up from previous races. With a field of 76 aircraft and improvements in engines, kit designs and flying experience, the increase was to be expected. It's interesting to note that Billy Hempel's 100-inch A-26 twin, which dominated the '91 Unlimited class, would have been competitive this year, but it wouldn't have been the fastest racer. As racing technology improves, aircraft specifications may need to be loosened to maintain variety in the competition.

AT-6 Texan racers generally posted relative speeds of 15 to 20mph above last year's. The AT-6 specs are the same, so the only major factor that can account for the increase is the substitution of the APC 22x10 prop for the Zinger 22x10 prop.

One thing is certain: the overall speeds for the Unlimited racers will continue to increase dramatically over the years, as the playing field is leveled owing to the availability of dependable engines, airframes, props, experienced pilots and callers. This phenomenon is already evident in the qualifying scores: in a field of 30, 11 seconds separated the top Unlimited qualifier from the bottom one, while for the AT-6s, only 3 seconds separated the top and bottom in a field of 20!

AT-6 RESULTS

Gold

Pos.	Team/Pilot	Race no.	Kit	Weight	Prize
1	**Hans Lieberman Racing/Mike Adams**	**16**	**Byron**	**25 lb.**	**$1,000**
2	Horndog/Gary Hover	027	Horndog/Bridi	28 lb.	$700
3	**Phugawi/Fred French**	**17**	**Byron**	**26 lb.**	**$550**
4	Crooks/Dennis Crooks	140	Horndog/Bridi	25 lb.	—
5	**ISC/Jim Goad Jr.**	**069**	**Byron**	**26 lb.**	**—**

Silver

1	**Mac Products/RC Country/** Icarus/Race Pro Engineering/ **Norbert Gruntjens**	**444**	**D&W Aircraft**	**25 lb.**	**$500**
2	Brown Boys Racing/Mike Helsel	15	Saxton	31 lb.	$350
3	**Don's Hobby Shop/Don Moden**	**125**	**Byron**	**28.5 lb.**	**$200**
4	Hobby Castle/Chuck Winter	60	Saxton	38 lb.	—
5	**Ruptured Duck Racing/Ken Jackson**	**033**	**Saxton**	**31 lb.**	**—**

Best of Show: AT-6

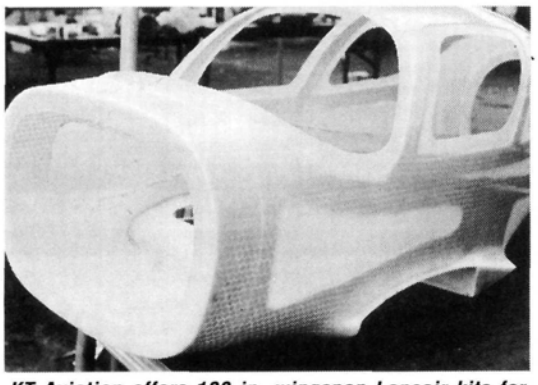
Denny Baker	690	Byron	32 lb.	$150

Two of the three exceptions were 7.4ci Stihl chain-saw conversions by James George; each won fifth place in its class (Silver and Bronze, respectively).

Of the rest, three were 3W 120s, two were Precision Eagle Twins, two were 4-cylinder, 4-cycle custom engines, and one was a Moki twin. In general, as the sport evolves, the engines are becoming more dependable and more powerful. The ability of multi-cylinder engines to smooth out any engine vibration that might result from engine run-out is a strong argument in their favor, and it is unlikely that a single-cylinder engine will win at Madera in the future.

Top 30 Unlimited Heat Point Winners' Engines

7—3W: twin cylinders
6—Aerrow 200: twin cylinders
5—Precision Eagle: twin cylinders
3—Aerrow 100: single cylinder
3—George 7.4 ci: single cylinder
2—Sachs 5.8: single cylinder
2—Custom 4-stroke: four cylinders

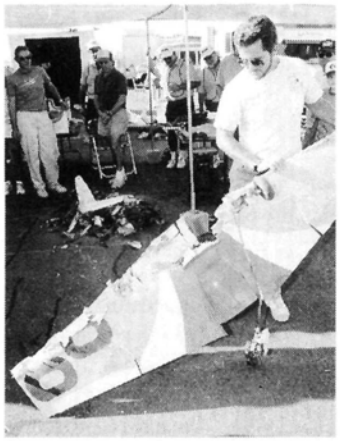


KT Aviation offers 100 in.-wingspan Lancair kits for sale. Kent McKenna flew one to the winners' circle, clocking over 170mph on the radar gun. Teardrop fuselage, high-aspect-ratio wings and a virtually enclosed Aerrow 200 are the ingredients of a fast airplane.

ENGINES

Once again, the Aerrow 200 dominated the trophy races. Five of the trophies—including first- and second-place gold—were taken by Aerrow 200-equipped aircraft. Of the 15 engines represented in the trophy races, all but three were multi-cylinder.

Nancy Bridi (far left), Lesley Burnett (left), and David Bridi (right) congratulate John Lockwood on his first-place Unlimited Bronze victory. John made a fairly painless transition from the aerobatic circuit where he has won numerous trophies in IMAC competition.



Don Rice surveys what's left of 1992 Unlimited Grand Champion race 00. Aircraft was destroyed after tuned-pipe-related radio failure caused it to plummet nose first into the ground past pylon 2. The wing, built by Paul Ross, was still capable of supporting the weight of two people after the crash.

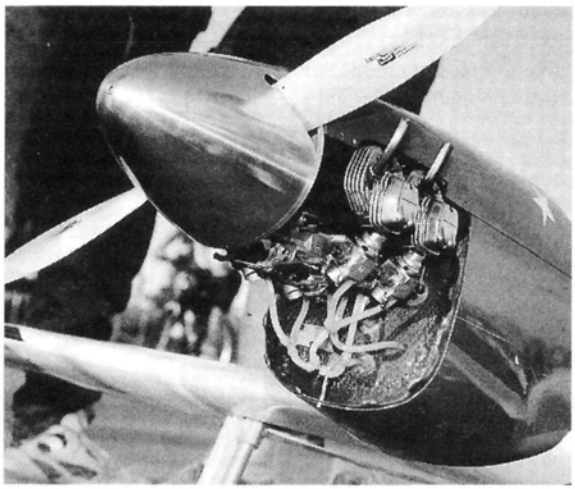
Bubba Spivey (foreground) tweaks Horndog Racing's Sky Aviation Stiletto. Wayne Voyles flew the James George 7.4 Stihl-powered race 02 to a fifth-place win in the Bronze class. Bubba and Wayne also put on a spectacular aerobatic show with two Lanier Stingers belching smoke.

1—Custom 7.4ci: single cylinder
1—Moki 3.6: twin cylinders

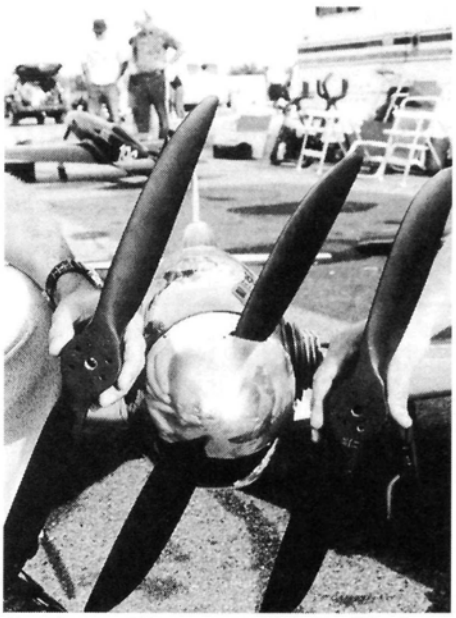
LIGHTWEIGHT/ HEAVYWEIGHT

Heavy airplanes with big engines did well at Madera '93. Of the 15 trophy contenders, only three weighed in at under 30 pounds (dry), and they took first-place Silver (Dan Gray), second-place Bronze (Bill Hempel, Jr.) and fifth-place Gold (Dan Gray). The rest ranged from 32 pounds (Cliff Adams, third-place Bronze), to 51 pounds (Mike Helsel, second-place Gold).

The conventional wisdom seems to be that a sturdy airframe is required for longevity, and that rigidity and strength with a powerful motor are the keys to success. Light airframes with heavy motors seem to have a problem with staying power, with the adage, "If you want to finish first, you must first finish," still holding sway.



This 4-cylinder behemoth was built by Jim Van Leeuwen from two O.S. 300 Geminis. It has original cylinders and pistons, but the heads have been highly reworked. The motor features titanium valves and an extra-light valve train. Jim also built the 4-cylinder flown by Cliff Adams in the first Madera race, but this one has 20 percent more power. On the bench, it turns a 20x20 at about 7,000rpm. Jim's next project? A scale racing V8 that will turn a variable-pitch prop. We'll keep you posted!



Dan Gray and his company, Aviation FX, have developed a line of custom props for the larger engines. Carbon fiber laminated over a hardwood core, the $200 props are repairable and capable of reshaping. They will work with the customer to develop the ideal prop for a given application. "Horsepower sells motors, and torque wins races," says Dan.*

TEAMWORK PAYS OFF

The Madera '93 story is all about the power of teamwork. Strong teams with solid relationships ruled the field. The M&K Racing Team (McKenna, Miller and Krohn) took along four entries. The skills and talents of this team are truly awesome: first-place Gold Unlimited trophy; top Unlimited qualifier (race 45, flown by Kent McKenna); second-place Gold Unlimited trophy (race 87, flown by Mike Helsel); fourth in Bronze Unlimited heat points (race 88, flown by John Krohn) and top AT-6 qualifier (race 88, flown by Scott Manning). This team epitomizes the concept of synergy, as it relates to human cooperation: the whole is greater than the sum of its parts! This group will be hard to beat in any race they enter.

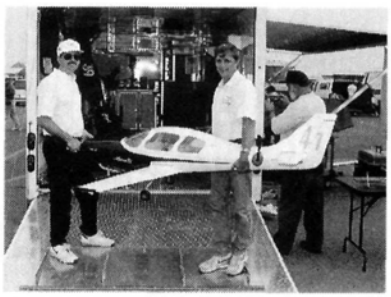
Other examples of the power of teamwork are: Aviation FX (first-place Silver Unlimited, fifth-place Gold Unlimited—both flown by Dan Gray); Braun Racing Team (fourth-place Gold Unlimited—flown by Don Albright; fourth-place Silver Unlimited—flown by Stinger Wallace); and RWR Racing (second-place Unlimited Silver—flown by David Smith; third-place Unlimited Silver—flown by Duke Crow). Team players win team sports, and giant-scale racing is no exception.

LUNCH BREAK ENTERTAINMENT

The exhibition flying during lunch breaks was also spectacular. Bubba Spivey and Wayne Voyles put on a smoke-filled, aerobatic ballet with their Lanier Stingers; Chip Hyde flew his TOC Ultimate (and torque-rolled it closer to the ground than you might believe); Kent Nogy and Ron Gilman provided a superb demonstration of the JPX Turbine Jet in a BVM Viper; and

MADERA

Robert Gorham put on a crowd-pleasing helicopter demonstration. Throughout the event, announcer Jim Van Loo did an excellent job of keeping the crowds posted. Thanks also to technical inspectors Jim Goad, Sr., Larry Maynard and Nick Ziroli, and to pace-plane pilots Ed Izzo, Jerry Kitchin, Cliff Weirick, Bill Thomas and, again, Nick Ziroli. With an event this large, there are too many hard-working people for us to be able to credit them all, but thanks to all the rest who made this grand event possible.



Charles Langdon brought several airplanes and a beautiful trailer/shop to Madera. Although none of his entries qualified to race, his enthusiasm was unshakable. "There's always next year," said the unflappable Langdon.

A LOOK INTO THE CRYSTAL BALL

The 1994 Madera race will be held at the end of September at Madera Municipal Airport. A new class will be added: 60 giant-scale Formula 1 racers. These racers, along with 100 AT-6 and 100 Unlimited entries, will compete for prize money. Specifications for the Formula 1 aircraft are still being determined at the time of this writing.

Contact Lesley Burnett* or David Bridi* for more information. To give every pilot a chance to race, Lesley plans to race the AT-6 class from day one next year. Total heat points will determine trophy race qualifications. The Unlimited staff is working on a way to increase race opportunities for the Unlimited class as well, but as of this writing, no decisions have been made. It's tough to spend the thousands of dollars required to take an aircraft to the races, only to stand by and watch for a week because you didn't make it into the heat matrix. The Unlimited staff are well aware of this problem and will attempt to address it for '94, perhaps by developing the Medallion class into a matrix.

In addition to the Madera races, two Unlimited/AT-6 Texan races are scheduled for 1994. The first will be held in Galveston, TX, on May 10 through 15. Hosted by Hi-G Promotions* and the City of Galveston, the races will be run according to GSARA rules and specifications. The one exception will be a downsizing of the specs for the Tsunami. Contact Hi-G for updates and entry forms.

The second combined race will be held at Reno, NV, in June. At the time of this writing, this race will follow RUMARA rules (models to be 22.5 percent scale military production aircraft made after 1939 and civilian aircraft that have qualified at Reno (no engine-size limit; scale judging). Contact Denise Bevard* for more information.

An AT-6 Texan race will be held at Aviation Expo in the summer, unless plans change. For more information, contact Joe Schumacher, c/o Aviation Expo*. Try to make it to one or more of these races; you won't be disappointed!

Gary Hover took second in Gold with AT-6 no. 027 (shown here in the pits). Chip Hyde (left) happened to be walking by while team member Bill Kitchen (right) contemplated changing the exhaust header. Note the black, fiberglass and resin air dam wrapped around the engine-mount area to minimize drag under the AT-6 cowl. The Zap sign in the background hangs on the rear of the announcer's booth.

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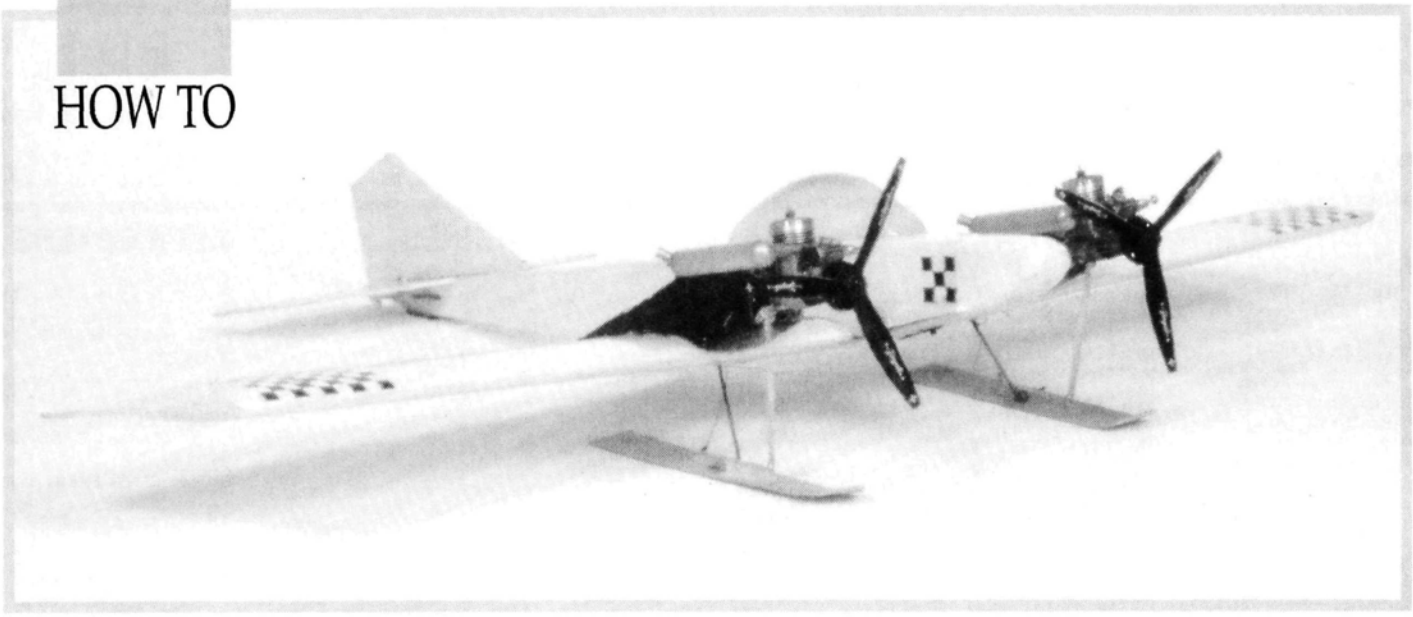
**Here are the addresses that are pertinent to this article:*
KT Aviation, *5913 Premiere Ave., Lakewood, CA 90712.*
Desert Aircraft, *P.O. Box 18038, Tucson, AZ 85731.*
Lesley Burnett, *c/o the Unlimited, P.O. Box X, Torrance, CA 90507.*
David Bridi, *c/o GSARA, 1744 Greenwood, Torrance, CA 90503.*
Hi-G Promotions Inc., *P.O. Box 219181, Houston, TX 77218.*
Denise Bevard, *c/o RUMARA, 6801 Flower St., Reno, NV 89506.*
Aviation Expo, *P.O. Box 498, Ankeny, IA 50021.* ■

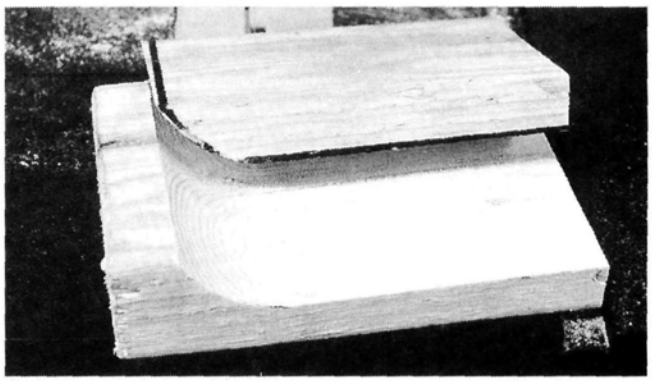
HOW TO



Photos by Dave Windom

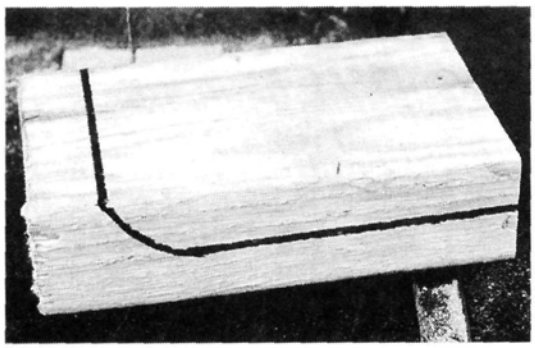
Wings of Winter Flying With Skis

by DAVE WINDOM



Make a press by carefully cutting along the outline of the ski using a band saw.

UP HERE IN the northwest corner of Montana—a stone's throw from Canada and just 90 miles west of Glacier Park—we have what you might call a short summer flying season. In '93, snow fell on August 20. If we flew only from bare runways, we wouldn't get much flying done during the year.



An outline of the side of the ski is drawn on the side of a 6-inch-long piece of 2x4 pine.

The fact is, some of us really look forward to the winter flying season and the unique fun it offers. The hearty souls that *do* brave the cold enjoy nearly empty flying sites and the camaraderie of fellow winter fliers.

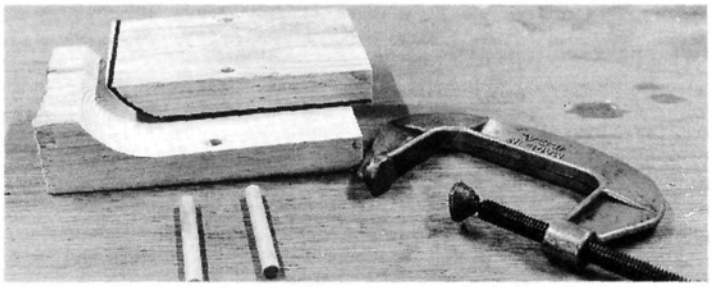
To fly from snow or ice, a flier must overcome some technical difficulties. If one of your club members has access to a snow plow and is willing to remove snow from your runways, you're all set. No modifications to your plane are needed. If you're stuck with runways that are covered with ice and snow, however, you will probably need something other than wheels to get your model airborne.

For us, one solution is to use one of the frozen lakes that dot the countryside in our neck of the woods. The wind tends to remove the snow or to pack it so firmly that wheels will roll on it as if they were on pavement. Not only that, but we also enjoy the advantage of having miles of runway and the ability to always land heading into the wind.

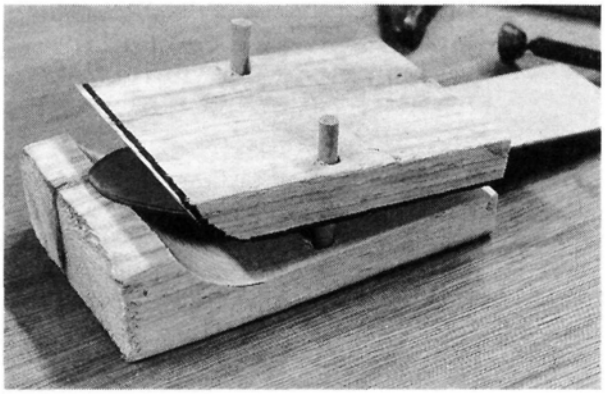
If you must fly from snow, your only choice is to use either floats or skis.

FLYING WITH FLOATS

If you fly off water in the summer, just put your plane back on the floats, remove the water rudders, and go for it! Floats tend to work much better than skis, especially on powdery snow. There's a real thrill in flar-



These are the finished parts of the press. Not including the C-clamps, it costs only 50 cents. (I had to buy a ¼-inch dowel.)

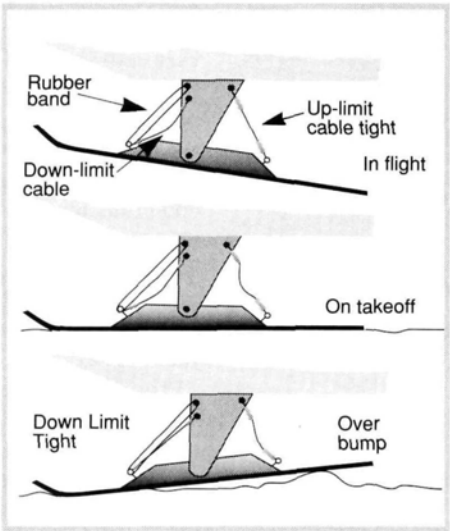


Place the hot, wet ski tip in the press, as shown. The clamping action of the press will pull the tip down into it. If the ski hasn't been boiled long enough, it will probably break at this point.

One maneuver that I do with this setup was suggested by my good friend Matt Jacobson at last year's Freeze Out Fly In. As I was taxiing on a frozen lake, Matt hollered, "Cut some donuts!" I raised the throttle to half to two-thirds, held full down-elevator and used full rudder deflection for my turns. Talk about fun—that is, until I slid sideways into an ice ridge and knocked the floats out from under my plane.

ing at touchdown—hearing the hiss of the floats as they ease into the snow and throw a rooster-tail of powder into the air.

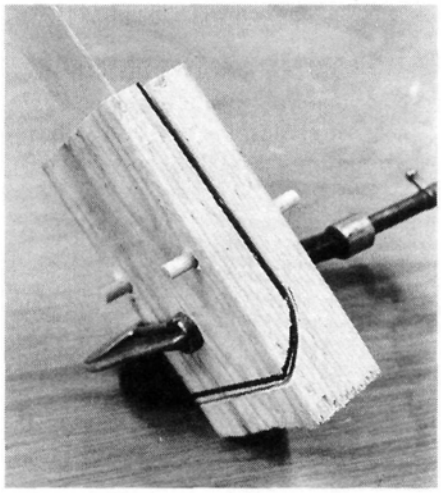
On the snow, flat-bottom floats seem to work better than vee-bottom floats. Flat-bottom floats tend to plane up out of the snow more quickly, and they hold up to the pounding of flying off snow—especially crusty snow and ice. I use a pair of home-made flat-bottom floats with an extra layer of 2-ounce fiberglass cloth on the bottom from the step forward. This setup is just about bulletproof. I once closed an automatic garage door on them, and they suffered no damage at all!



Top drawing: when the aircraft is in flight, the rubber band will pull up the ski tip, the down-limit cable will become slack, and the up-limit cable will become tight.• Center drawing: as the aircraft moves along the snow's surface tail up, both limit cables are slack, and the rubber band absorbs the shock from the bounces. • Bottom drawing: the down-limit cable prevents the ski tip from digging into the snow when it goes over bumps. The up-limit cable becomes slack, and the down-limit cable becomes tight.

CROSS-COUNTRY CRAFT

The other option is to use skis like the ones full-scale aviators use. I'll describe how to set up and build a set of skis for about three bucks. I learned this method from a veteran RC'er who had learned it



Clamp and leave overnight.

from someone else. So it's not original; but it's cheap, and it works.

To make a press, draw the side view of a ski on the side of a 6-inch-long 2x4. Using a band saw, cut along this line, and separate the halves of the press. No sanding is needed on the inside. Actually, a rough surface will help to grip the ski. Put the halves back together, and drill a ¼-inch hole vertically through the press on each side, about ½ inch from the sides. Trial-fit ¼-inch dowels through the blocks. The dowels will keep things from sliding around when you clamp the ski between the halves.

For each ski, cut a 2-inch-wide strip of 1/16-inch plywood about the same length as the width of your airplane's wing chord.

WINTER Flying Tips

Sunglasses are a must. If the sun is out, snow blindness can be a problem, so play it safe. It can be really tough to see a white airplane against a white background, so I wear blue-blocking, amber sunglasses.

Wear multiple layers of clothing that you can take off or put back on to suit changing temperatures. A hat is also a must. Use two pairs of gloves: a light pair for working the transmitter and a heavy pair. I like to use army wool glove liners; they're light and warm, and they give me enough "feel" to fly by.

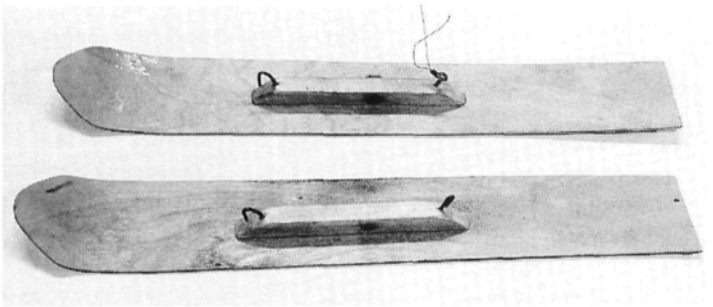
Engines can be a little cranky to start if it gets really cold. Try using a fuel with a higher nitro content than the fuel you've been using.

Plastic covering tends to become brittle when it's cold, so be careful when you're working around open-span wings and airframes. I once dropped my Ni-Cd driver, and it went clear through the wing of my Spitfire without slowing down. Plastic hinges can also break easily when it's cold.

Battery output goes way down when the cells get cold, so keep the transmitter in your car. If your receiver pack is easy to get to, keep it in your pocket until you're ready to fly.

If you're going to use a frozen lake as a flying site, first make sure it's safe. Ask a local ice fisherman or the authorities what constitutes safe ice. If you don't know, don't go.

Above all, know how to recognize and treat frostbite and other injuries caused by cold. Remember that your face and your fingers are very vulnerable to the effects of cold.



The finished skis get a simple mount and are then sprayed with clear poly and waxed.

Flying from the snow can add a whole new dimension to your hobby and can be loads of fun.

It's a rough estimate that I use for determining the length of the ski. A wider ski doesn't really seem to help. (By the way, my construction method is known officially as TLAR: that looks about right.)

Round one end of the ski, and then soak the tip in boiling water. When the tip is somewhat soft, place the ski in the press, push the dowels into place, clamp the press closed using a C-clamp, and let the ski dry overnight. In the morning, remove it, and attach it to your landing gear using whatever method you prefer.

I finish my skis with clear poly varnish and a coat of cross-country-ski glide wax. The glide wax prevents snow from sticking to the ski's surface and causing drag during taxiing.

SKI TIPS

It's important to ensure that your skis tip up at the same angle. To do this, I use a method similar to one used by full-scale aviators. I use a rubber band to raise the ski tips and a piece of 90-pound test monofilament limit cable to restrict how much the skis tip up. I've found that 10 to 15 degrees works pretty well; more up-angle adds quite a bit of drag, and running with less angle increases the chance that the ski tips will snag on landing and cause the plane to flip over.

To prevent the ski tips from being flipped down and snagging the snow, I also use down-limit cables. Again, monofilament line serves well.

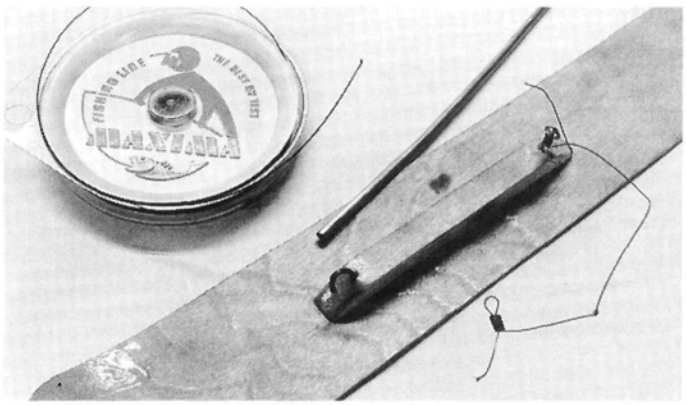
To set the limit cables, place the model on a hard surface with the skis attached and the rubber bands off. Lift the tail, and block it in place so that the nose is pointed 10 to 15 degrees downward. Run the up-limit cable through the mounting holes, cinch it, and crimp it in place. Then reverse the procedure; lower the tail so that the nose of the model points 10 to 15 degrees upward, and insert, tighten and crimp the down-limit cable in place. With the rubber bands back in place, both skis should have the same amount of up and down travel.

Watch the rubber bands for signs of decay, especially if your exhaust blows on them. A broken band can cause the ski tip to flip downward instead of upward. Things get interesting really quickly when you suddenly have one ski pointing upward and one pointing downward. Mounting the landing-gear mount slightly forward of the center of gravity on the ski can help a little in case the band breaks.

Properly set, the skis will work independently on the snow and will snap to the same angle when the plane lifts off.

SKIMMING THE SURFACE

Now that your plane is equipped with a new set of skis, it's time to try them out. Ski-equipped models perform best on snow that's covered with a fairly firm crust. It will be much more difficult for your model to break loose from powdery snow. In powder, tail-draggers have an advantage over trike types because you don't have to put a ski on the rear of a tail-dragger; you can just let it drag through the snow.



I use heavy monofilament line to make limit cables, and I make the crimps from pieces of brass tube. I also add a drop of thin CA for good measure. The total cost is less than $3.

Flying off powdery snow is very similar to flying from water. With a tail-dragger, the skis tend to sink into the snow, and so does the tail, to a certain extent. Slowly add power while you apply up-elevator. Snow has an amazing amount of suction, so it may take a while for the model to get onto "the step" and get the skis planing across the top of the snow, instead of plowing through the drifts. When the model breaks loose, relax the up-elevator, and take off as soon as you have sufficient air speed.

Flying a trike-geared model in powdery snow can be a real challenge. Unlike in firm snow, a lot more up-elevator is required to lift the nose ski up onto the snow's surface. Meanwhile, the main skis always seem to be dragging along just under the surface of the snow. There have been times when I've found it just about impossible to fly with a tricycle setup. It could be that a wider ski set would be required.

Flying a three-ski setup on firm snow can be a ball of fun. A nose ski, however, isn't as effective at steering as a nose wheel, and it tends to slide sideways across the snow instead of turning the plane. To maintain directional control, I either add edge blades or glue a 90-degree brass strip to the bottom center of my ski.

A reliable idle is very important when flying with skis. Avoid walking on the area that will serve as your runway. Footprints make great ski traps, and if a ski falls into one, it can cause lots of damage. So taxi to and from your runway.

Properly set, your skis will hardly affect your plane's performance; but because they tend to act like flaps, they might reduce its landing speed slightly. This may actually be an effect of the density of the cold air. We pylon-race with skis and have found that they don't affect high-speed flight all that much.

Flying off snow can add a whole new dimension to your hobby and can be loads of fun. Invite some flier buddies to come along, break out the chili and cocoa, and have a great time. ■

HOW TO

Make a Compact Light Aircraft Support System

by RICH URAVITCH

THE NEXT TIME you're at your flying field, notice what's being used for field boxes. My club is pretty typical, I guess, and I've seen everything from reworked milk crates and hastily hacked foam ice chests to really high-tech, "it carries everything including my spare back brace" field boxes. The ones that *really* get me, though, are those walnut beauties with hand-carved inlays depicting aviation epochs, such as Lindbergh's adventure, or an F-4 putting the zap on some unlucky MiG somewhere over South Vietnam. Add to this list those with exterior surfaces that rival the "Best Finish" award recipient at major competitions! Form, too often, outdistances function!

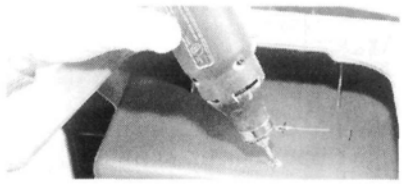
SOME CLASS

I've been in the hobby long enough to recognize what equipment I need to support my airplanes at the field. This comes after many attempts to assemble the "ideal" package, whose purpose is to hold everything I need for an enjoyable day at the flying field without needing a truck to get it there. The basic requirements are simple enough:

Except for fuel, which I carry separately anyway, the CLASS package is all I need to bring to the flying field with my giant T-6. The air pump that's built into the CLASS is very handy for servicing retract-equipped models. The nice part is that you can perform this operation while sitting down!

A FIELD BOX WITH CLASS

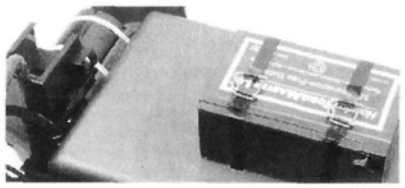
Here are the basic components required to produce your own unit. If you're a smart shopper, you'll spend less than $60!



Use a Dremel tool with sharp cutting bits to make all the holes and slots. Here, the air-pump retaining slots are being cut (after the proper positions have been marked).

Use nylon ties to hold the air pump in place. Put a small piece of foam rubber between the pump and the case to minimize vibration.

After selecting a convenient spot for the air pressure gauge, cut a hole in the case. Be careful not to remove too much material because the gauge is a friction-fit. The light-colored object that shows through hole is a nylon T-fitting.



Secure the 12V gell-cell battery to the bottom of the case with two fiberglass packaging straps and two clips.

LIST OF COMPONENTS

PART	SOURCE
• Rubbermaid step-stool toolbox	Home-supply store
• Mini air compressor with air gauge*	Auto-supply store
• 12V, 5 to 7A gell-cell battery	Hobby-supply store
• 12V DC, on/off rocker switch	Auto-supply store
• Vacu-Tite (no. 47322) nylon hose tee	Auto-supply store
• Insulated banana jacks (no. 274-725A)	Radio Shack
• Plugs to match the jacks	Radio Shack
• Single-female-to-dual-male quick disconnects (no. 64-3061)	Radio Shack

**If the air compressor doesn't come with an air gauge, an inexpensive, plastic 0 to 120psi gauge can be purchased separately at most auto-supply stores.*

The "football" filler pin (lower right), which comes with the air compressor, attaches the fitting to the connector on the end of the air-pump hose. Cut off the end of the pin, slip it into a short length of retract air line and assemble various adapters that will allow you to fill the air tanks of different retract systems.

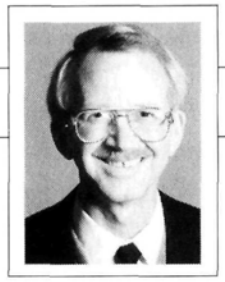
A small fishing-tackle box and a plastic parts container keep everything organized while supplementing the supplied tray. A quick charger and a protective starting glove also fit inside easily.

functional, sturdy, compact and light. Because every workable design represents a compromise ("trade-off" in aero-speak), I put together a small group of seemingly non-related components to produce a functional field-support box that can be further tailored to suit even more specific needs. I call it CLASS (Compact, Lightweight, Aircraft-Support System).

The nice part about this system is that it cost me *less* than 60 bucks and was assembled in a leisurely afternoon. The photos and components list should answer most of your questions. The key to the utility of this field box is the external (but protected) mounting positions for the air pump, the gell-cell battery and the air-delivery lines. The inside of the basic box is left empty for other goodies. A small fishing-tackle box fits nicely inside the basic box to serve as a great organizer for larger tools. A "power panel" could be attached to the side opposite the air pump for those of you who wish to incorporate one to suit *your* needs.

After using the box for two seasons, I've found very little need to modify it further. Its primary objectives seem to have been accomplished: it provides a functional support equipment package for my models, and it offers me a place to sit and ponder my next project. Unlike other neat ideas that may die on the vine, this is one you *should* sit on! ■

ELECTRICS



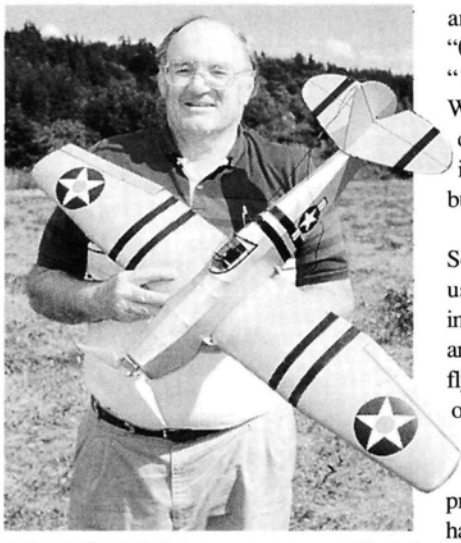
MITCH POLING

NEW THOUGHTS ON GEARED SYSTEMS

GEARING HAS TRADITIONALLY been recommended for lightly loaded, slow-flying planes that need a lot of thrust at low speeds; for example, motor gliders and old-timers. Not any more! Gearing can also be used for very high-performance planes that fly fast, aerobatically and nearly vertically. It can transform a motor that has good performance on six or seven cells into a powerhouse on nine cells. Before I get into the details, some background is necessary.

Several years ago, I wrote a series of columns on how to determine the armature resistance and the speed constant for motors. These two numbers are very powerful. They can allow you to predict the performance of a motor in a surprising variety of situations, such as with different voltages, propellers and current draw. All that's required are two motor runs: one with a light load and one with a heavy load. You'll also need an ammeter, a voltmeter and a tachometer. The sidebar "Motor Equations" shows the equations that you can use to calculate the speed constant, the armature resistance, motor efficiency, rpm and power output.

I wrote a program in BASIC for all this; the program can also calculate propeller sizes and motor thrust. If you want a printout of the three-page program, send a dollar bill for the cost of the copying, and an SASE (use a business-size envelope and a 29-cent stamp) to me. I will include instructions on how to do the testing. It's a bargain! You'll need to do two pages of typing in BASIC, and you may have to modify some commands if your computer isn't a Commodore.



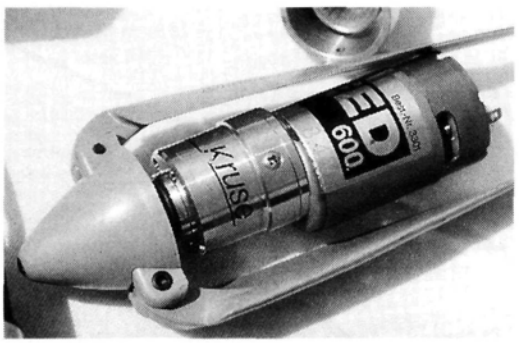
Roland "Pete" Petersen, owner of Model Electronics Co., proudly displays his awesome P-47 Thundervolt—great performance!

MODEL ELECTRONICS

This leads up to some of my latest flying activity. I've been flying the Model Electronics Corporation* power system in my Aqua Sport and in my Piper Cub. The Piper Cub is an all-foam plane that has been manufactured for many years by Sure Flite. Model Electronics sells the Cub with special instructions and material for electric flight. It's designed to fly with the Model Electronics War Emergency Power (WEP) motor and the Model Electronics Super Box 6:1-ratio gearbox. The WEP motor is similar in size and appearance to the R/C car off-road "05" (100W) motors, but it's producing "15"-size (170W) power. Thanks to the WEP and the Super Box, I have been discovering things about gearing and folding props that are common knowledge, but are new for me.

The Model Electronics power unit uses Sonic Tronics* folding props. I've never used folding props much, and I'm very impressed with the Sonic Tronic props; they are powerful and efficient. Now, for most flying, I think that any prop that's 9 inches or larger in diameter should be a folding one. The Sonic Tronic folding props avoid the bent motor shaft/busted prop problems. I live in the countryside, and I have all the flying fields I need just outside my back door. The problem is that they are mostly plowed fields, so landings are rough and dirty. If I wasn't using folding props, I would break a prop or bend a motor shaft on every landing. As it is, all I have to do is clean off the mud!

The Sure Flite Airacobra is also sold by Model Electronics with the WEP unit.

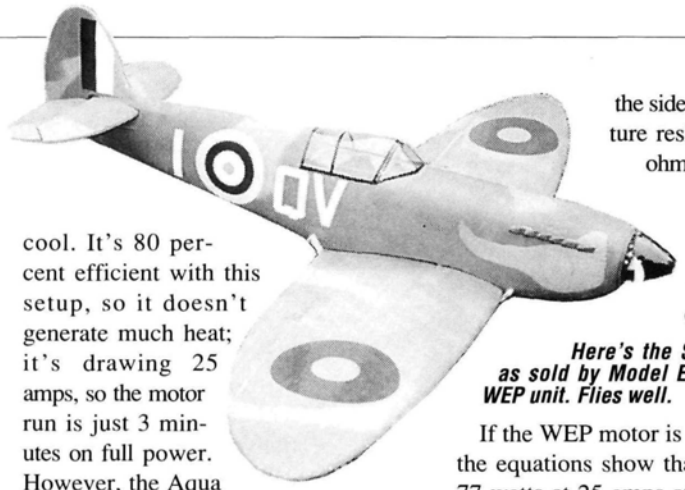


The Intro Gear 400 with the Graupner Speed 600 motor is a good-looking gearbox; it's rated for up to 600 watts.

BENEFITS OF GEARING

I have also become a believer in gearing. The Model Electronics Super Box and WEP motor and a Sonic Tronics 13x7.5-inch folding prop turning 5,600rpm is a potent combination! It hauls my Aqua Sport on floats upward at a 40-degree angle on 9x1400mAh Sanyo SCR cells. This is better than the Keller 25x12 that I had in it before (on 12 cells).

The WEP motor turns 36,000rpm! In spite of the high rpm, the motor stays

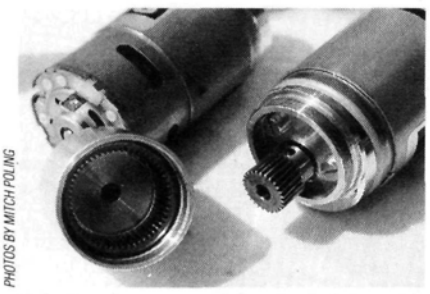


Here's the Sure Flite Spitfire as sold by Model Electronics for the WEP unit. Flies well.

cool. It's 80 percent efficient with this setup, so it doesn't generate much heat; it's drawing 25 amps, so the motor run is just 3 minutes on full power. However, the Aqua Sport only needs half power for good flying, so most of my flights are 5 to 7 minutes long using the Astro 205 throttle. The performance of the Model Electronics unit is so good that it started me thinking in general about what gearing can do. The motor parameters described earlier tell the story.

Electric motors have one flaw as far as we are concerned. They are at their highest efficiency at lower current draws and are much less efficient at peak power. Wouldn't it be wonderful if the peak efficiency and the peak power were at the same current draw? Well, that can't be done; but gearing offers a way to get both high power and high efficiency. Let's see how this can be done.

On nine 1400mAh cells, the WEP motor (without a prop) turns 50,400rpm at 11.23 volts, 3.6 amps. It turns 39,300rpm with a Sonic Tronics 11.5x7.5 folding prop (6:1 reduction) at 9.60 volts, 20.6 amps. After I run this through the equations I've described in the sidebar, I get an armature resistance of 0.0473 ohm and a speed constant of 0.219 volt/KRPM (KRPM =1,000 rpm). Now we can play!



PHOTOS BY MITCH POLING

Note the ring gear and the steel pinion with a setscrew in the interior of the Kruse Intro Gear 400.

If the WEP motor is run on five cells, the equations show that it can produce 77 watts at 25 amps at 72 percent efficiency. If you drop down to 15 amps, the motor is 86 percent efficient, but it only has 65 watts output. On seven cells at 25 amps, it can produce 124 watts output at 81 percent efficiency. On nine cells at 25 amps, it produces 171 watts at 85 percent efficiency! Note: these efficiencies are higher than in the real world because the equations assume that you have a lossless motor. Nevertheless, the motor is close to 80 percent efficient at a power level of 170 watts, which is very good.

The motor turns 33,000rpm, which doesn't bother it, but other than ducted fans, there's no prop for it! This is where gearing saves the day. Any ratio starting from 2:1 can be chosen, but the 6:1 ratio offers the choice of the large Sonic Tronic props at 5,600rpm. Large props are more efficient than smaller props, and their thrust is higher—over 3 pounds for the 13x7.5 prop. The 7.5 pitch allows flight speeds of 40mph or better (props can fly faster than their pitch). The result is lots of power, lots of pull in the climb and lots of fun!

Note that the gearbox has to handle high power. The Super Box is the only gearbox that I know of manufactured in the USA that can handle 200 watts and that has ratios in the 4:1 to 6:1 range. The Super Box housing is made of machined aluminum with ball bearings for the output shaft. It fits motors with an 1/8-inch shaft, the standard size for 05 motors. The output (spur) gear is nylon and is available in 34-, 36-, 38- and 60-tooth sizes. The press-on brass pinion gear is available in 10-, 12- and 14-tooth sizes. The 60-tooth spur gear and the 10-, 12- and 14-tooth pinion gears give ratios of 4.3:1, 5:1 and 6:1.

I recommend that you get spare spur gears. I always use a 30A fuse for

MOTOR EVALUATION EQUATIONS

Use two runs for this test: one with a prop and one without. Measure the voltage at the motor terminals; measure amperes; measure rpm.

RPM1 = rpm of the first run
RPM2 = rpm of the second run
A1 = amps for the first run
A2 = amps for the second run
V1 = volts for the first run
V2 = volts for the second run

Armature Resistance (Ra)
Ra = (V1-V2xRPM1/RPM2) / (A1-A2xRPM1/RPM2)

Motor Speed Constant (Km)
Km = 1000 x (V1-V2xA1/A2) / (RPM1-RPM2xA1/A2)

For any motor run, A = current in amps, and Vt = voltage at motor terminals.
Motor Power Output in watts (Po)
Po = (Vt-AxRa) x A
% efficiency = 100xPo/VtxA
RPM=1000 x (Vt-AxRa)/Km

Note: these equations assume that the motor is "lossless," i.e., it needs no energy to turn itself. This is good enough for most hobby motors except near zero current.

Once you have the power out, the following equations are very useful.

The Abbott equation:
Power (watts) = $PxD^4xRPM^3x5.33x10^{-15}$

Note: this will let you determine pitch or diameter for a prop, given Po.

My equation for thrust:
Thrust (ounces) = $PxD^3xRPM^2x1.0x10^{-11}$

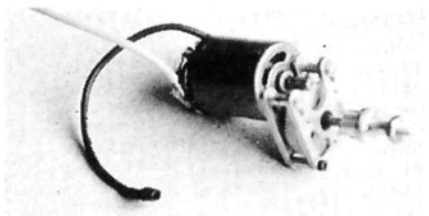
Note: P = pitch; D = diameter. The 1.0 is a "form factor" and can vary from .8 to 1.4, depending on the prop blade shape; 1.0 is an average value.

on/off in my planes for safety. Nevertheless, I damaged a spur gear in a bad hand launch that resulted in a nose-in. The pinion damaged the spur gear before the fuse blew, and the fuse blew before I had time to turn off the motor from the transmitter! Spur gears cost only $4; it makes sense to have several in reserve.

I also recommend that you purchase the Model Electronics Pinion Plucker for installation and removal of the pinion gears. This tool can install and remove press-fit gears without damage. The Pinion Plucker costs $9.95; pinion gears cost $3.50 each; the WEP motor costs $80; and the Super Box costs $42.50.

CHOOSING A MOTOR

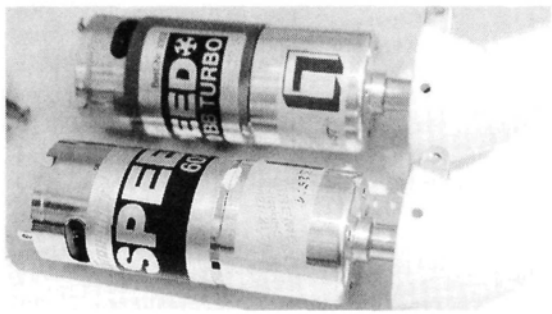
The WEP motor has an exceptionally low armature resistance combined with a fast speed constant. This makes it especially well-suited to the high-power setups. If



The WEP motor and Super Box.

you want to try high power with other 05-type motors, be cautious: most of the ones used for electric flight can't stand up to the higher voltage and current. For example, a stock 05 motor with an armature resistance of .165 ohm and a speed constant of .300 volt/KRPM (typical values for a sport 05) would suffer meltdown! On nine cells and at 25 amps, it's only 49 percent efficient, it produces only 94 watts, and it cranks out 100 watts of heat! Your plane would be shot down in flames.

On the other hand, the "modified" motors used in off-road R/C car racing look good. The DuraTrax* Powerline 18-turn modified motor from Tower Hobbies has an armature resistance of .051 ohm and a speed constant of .269. It should do all right on nine cells with a 4:1 or 5:1 gearbox. Remember that the important number is the armature resistance: if



The Ludwig 600 gearbox with the Graupner Speed 600. Beautiful workmanship—ideal for "9-cell class." This one has a ratio of 3.25:1.

it's .06 ohm or less, it's suitable for a "hop-up" to nine cells. My guess is that most modified motors with 18 turns or less would qualify.

The motor you choose can be single-wind, double-wind, triple-wind, or quadruple-wind (quad). This refers to the number of wire strands used. A double-wind, 18-turn motor has two strands of wire wound 18 times around each motor pole. This offers a lower armature resistance than the same number of turns with a single wind. The WEP motor is a triple-wind. I think that any type of wind will be all right.

By the way, the references to "4.9 wet magnets" and "4.95 wet magnets" that you see in the advertising for modified motors refers to the thickness of the magnets. A 4.95 magnet is 4.95 millimeters thick. The magnet thickness is probably not very critical. The gearing depends on the speed constant. Some rules of thumb are:

- a speed-constant value of .220 to .240 uses 6:1 gearing;
- a speed-constant value of .240 to .260 uses 5:1 gearing;
- a speed-constant value of .260 to .300 uses 4:1 gearing.

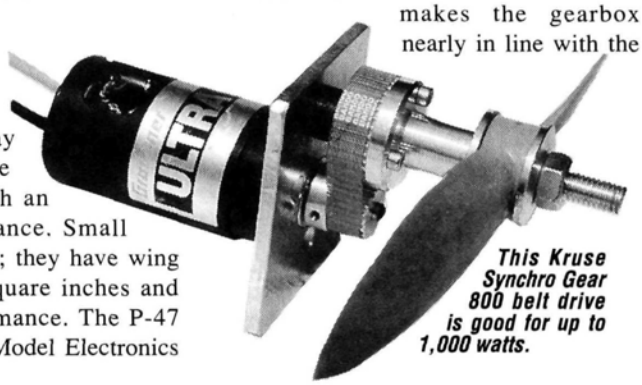
NINE-CELL CLASS

Now we have an entirely new ballpark to play in! We can call this the "nine-cell class," with an emphasis on performance. Small "warbirds" are naturals; they have wing areas of 430 to 500 square inches and nearly vertical performance. The P-47 Thundervolt kitted by Model Electronics is a good example. I was flying the Thundervolt at a field where some gas planes were flying. A spectator nearby was making comparisons and remarked, "Electrics sure have more power than gas!" Sometimes they do!

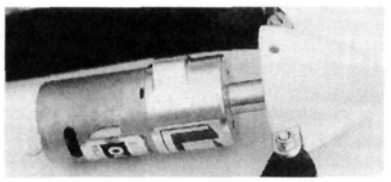
Model Electronics also sells the Sure Flite Supermarine Spitfire and the P-39 Airacobra with the materials and instructions needed to fly them electrically with the WEP power unit. These have a 50-inch span and perform very well. Model Electronics has done its homework. Fly for fun; fly nine cells!

NEW GEARBOXES

Gearing is also getting attention in Germany, where there are several new gearboxes available that feature computer-controlled machining. These gearboxes are of very high quality, and they are pretty to look at—something I've never said about gearboxes before! The Modellbau-Technik Kruse* gearboxes are made for very high-power applications. The gears are made of steel and are mounted in ball bearings; their housing enclosure is machined aluminum. The Intro-Gear 400 can handle up to 600 watts, and it's designed for the Graupner* Speed 600 or motors of similar size. That size would include most 05 (100W) to 075 (125W) motors, 540- and 550-size motors, off-road motors, Astro cobalt 035 and Astro cobalt Turbo 05 motors, and any other motor that has an 1/8-inch motor shaft. The reduction is 2:1. The gearbox features a ring gear (thus, the name Intro-Gear) that makes the gearbox nearly in line with the



This Kruse Synchro Gear 800 belt drive is good for up to 1,000 watts.



This sturdy Ludwig 400 gearbox is set up for duration or solar flight.

motor. The motor and the prop run in the same direction, and the motor does not need to be reverse-timed. The pinion is installed with a setscrew—a feature I like. (Most gearboxes use press-on pinions, which are not as convenient.)

The Intro-Gear 400 weighs 54 grams (1.9 ounces) and costs DM150 (about $94). The Intro-Gear 1000 is its big brother; it's rated for 1400 watts (almost 2hp!) and should handle motors up to the Astro 90. It has the same features as the 400, weighs 115 grams (4 ounces) and costs DM219 (about $138).

Kruse also makes two belt drives: the Synchro-Gear 800 for motors up to 800 watts; and the Synchro-Gear 2500, rated for an incredible 2500 watts. Are there any model aircraft motors that big? I don't know of any. The belt drives have reductions available from 1:1.5 to 2.4:1. The 800 weighs 70 grams (2.5 ounces), the 2500 weighs 130 grams (4.6 ounces), and they each cost DM150 (about $94). The 2500 would be the way to go for 1/3 scale. For that matter, full-scale electric airplanes have flown on 2500 watts.

The Ludwig Feinmechanik* company takes another approach to gearboxes. They use a pinion, then a 2:1 intermediate gear and then the final drive gear sized for the final ratio desired. This is all housed in a beautifully machined aluminum case. The intermediate gear is small enough to cause only a small bump on the case housing, and the housing is in line with the motor. The motor and the prop turn in the same direction, so there's no need for reverse-motor timing. The pinion gear is the usual press-on type.

(Continued on page 101)

AEROBATICS

(Continued from page 13)

flip of a switch reduces throttle to 70 percent power, this may prove to be helpful. The new Futaba* 9ZAP has a new feature that lets you change control inputs for different flight conditions; it's particularly good for this kind of maneuver because you can put in an adjustable time delay.

EXTRA TIPS

If the first roll is to the inside, i.e., starting from left to right, rolling left, don't apply left rudder to yaw into the turn. It may seem correct, but it's unnecessary. It's easier just to roll left and add up-elevator to provide the heading change and then add rudder to maintain altitude.

If you're trying to do a rolling circle and you're alternating the direction of the rolls, rudder application direction can be confusing. A simple trick is to apply the last rudder to start the new roll. Think about it; it works. In fact, I don't take all the rudder out; I leave just a little in at the end of each roll so that there's no question which rudder to apply.

CLOSING

So there you have it; a well-executed rolling circle is done by mixing rudder and elevator constantly with precise timing and rates of deflection. It takes a lot of practice and thought to figure out how to constantly improve your results. I hope this will encourage you to give the infamous rolling circle a try.

See you next month!

**Here are the addresses of the company mentioned in this article:*
***Carl Goldberg Models,** 4734 W. Chicago Ave., Chicago, IL 60651.*
***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.* ■

ELECTRICS

(Continued from page 93)

All the gears are made of brass and are mounted in ball bearings. There are two sizes—the 400 and the 600. The 400 is intended for motors like the Graupner 400, the Mabuchi 380 and other motors that have a 3/32-inch motor shaft. It would have made a very fine solar or duration gearbox, but the gearing setup does not accommodate shaft sizes other than 3/32 inch. The 400 gearbox comes in 5.9:1 and 5.2:1 ratios. A Graupner Speed 400 7.2V motor is included with the gearbox, and the price is DM119 (about $75).

The 600 is intended for motors with the 1/8-inch motor shaft that is standard for most 05 motors (100 watts). The available ratios are 3.24:1 and 2.65:1. The gearbox comes with a Graupner Speed 600 12V motor, and costs DM139 (about $87). The wattage rating isn't given, but I think the 400 could easily handle 100 watts; the 600 version could handle up to 300 watts.

In the USA, Astro Flight* makes very sturdy and high-quality, machined gearboxes. The output gear is made of steel and is mounted in ball bearings; the housing is made of machined aluminum and is open at the bottom; the press-on pinion gear is brass. The motor must be timed to run in reverse. Astro Flight makes the following gearboxes:

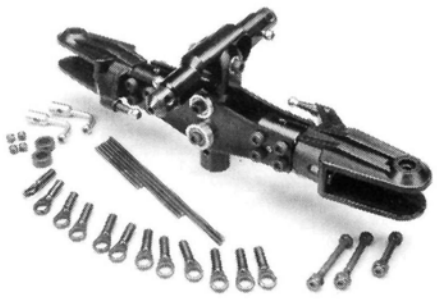
- The 4046 has a 2.38:1 ratio, it fits the 1/8-inch shaft of the 05 motors, and it costs $34.50.
- The 4033 has a 2.38:1 ratio, it fits 5/32-inch shafts (such as the Astro cobalt 05 and 15), and it costs $39.50.
- The 4041 has a 1.82:1 ratio, it fits 1/4-inch shafts (such as the Astro cobalt 25 and 40), and it costs $44.50.
- The 4043 has a 1.82:1 ratio, it fits 3/16-inch shafts (such as the Astro Ferrite 25), and it costs $39.50.

Wattage ratings are not listed for these gearboxes, but the 4046 and the 4033 should handle 300 watts, and the

(Continued on page 115)

NEW HELI PRODUCTS

GREAT PLANES
Kyosho Zeal Z-32 Rotor Head

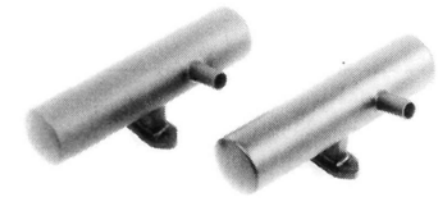


Use this rotor head to upgrade your Concept 30 helicopter. It has a traditional seesaw style that can use hard dampers for aerobatics, or soft dampers for stability. It includes 10 ball bearings and stamped, Duraluminum side hub plates that provide maximum precision, rigidity and durability. Thrust bearings are available separately. The Zeal Z-32 Rotor Head must be used with the Concept 30 SR long mast. A stabilizer bar and blades aren't included.

Part no.—KYOE6301; **price**—$189.95.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

ALTECH MARKETING
Hirobo Side Exhaust Mufflers



Made of light aluminum, these side exhaust mufflers fit the SST-Condor, the SST-Eagle, the Tsurugi, the TOW Cobra and the Bell 222 .60- to .80-size helicopters. The mounting flange is welded to the main body of the muffler, so parts that commonly fail, such as silicone O-ring couplers, aren't needed. A pressure tap is included.

Part nos.—0404340 (for O.S.), 0404341 (for Enya and Y.S.); **price**—$89.50.

Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391; (908) 248-8738.

JR REMOTE CONTROL
Piezo Electric Gyro

This gyro has a crystal motion-sensing unit. Three crystals, one of which is made to oscillate, have been bonded in a prism. As the model moves, two of the crystals sense a relative distortion in the third oscillating crystal. Sensing this distortion, the gyro provides an electrical feedback to the servo to counteract the initial motion. Because the motor, the flywheel and the other mechanical parts in a standard gyro have been eliminated, the Piezo is 10 times more sensitive. That means more consistent pirouettes, more aggressive stops and enhanced overall performance. It has a virtually unlimited operational life because there aren't any moving parts that might break. It's compatible with JR and other radios. Specifications: power required—4.8 to 6 volts; current drain—80mAh; total weight—3.10 ounces; total volume—4.79ci. Dimensions: gyro unit—1.30x1.30x1.33 inches; weight—1.52 ounces; amplifier—1.51x2.10x.65 inches; weight—1.16 ounces; remote gain adjust box 0.93x1.36x0.39 inches; weight—0.42 ounces.

Part no.—JRPG 1000; **price**—$399.95.

JR Remote Control; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511. ■

Descriptions of new products appearing on this page were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute an endorsement by **Model Airplane News**, nor does it guarantee product performance or safety.

'93

Hirobo Cup

by TIM DIPERI

Winners, left to right: Mike Mas (fourth), Cliff Hiatt (first), Ray St. Onge (third) and Tom Dooley (second). As top Hirobo pilot at this event, Dooley went on to compete in Japan, where he placed second against the world's finest.

IT WAS a picture-perfect mid-August day. Colts Neck, NJ, was the site of one of the season's biggest helicopter events. Organized by Altech Marketing and Hirobo Ltd., for the second consecutive year, the two-day production attracted competitors from coast to coast. And why not? The top-placing Hirobo pilot would get an all-expenses-paid trip to Japan to compete in the Hirobo Cup Grand Final.

In addition to attracting some of the nation's top talent, the event drew several hundred other modelers (with almost 200 helicopters) who wanted to have their equipment tuned up by the Hirobo field reps. It looked like an assembly line: tables covered with helicopters and tools and surrounded by eager modelers who were ready to learn.

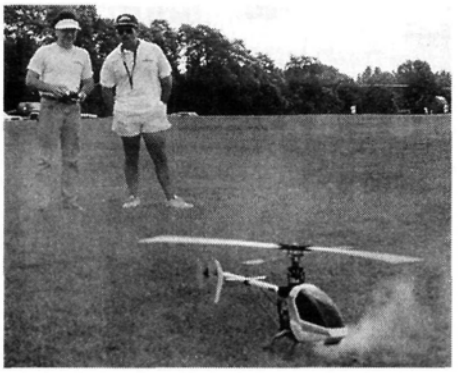
U.S. Army National Guard pilots from the Aviation Support Facility, Mercer Airport, West Trenton, NJ. CW2 Pete Vieghwea (left) and Sgt., Christopher Gould.

AN EVENT FOR PROS AND BEGINNERS

THE EVENT

▶ **Day 1—Saturday.** After coffee and doughnuts (thanks, Altech), Mike Mas and I were soon working on helicopters, and Tom Dooley, Tom McAteer and Nob Muraki were flying them. We were there to point modelers in the right direction and to ensure their success in the hobby. Everyone who wanted help got it—regardless of the age or brand of his heli. We were so busy that we had to bring in more tables and convince the helpful members of the Helicopter Enthusiasts of Long Island to give us a hand. (Thanks, guys!) Even Curtis Youngblood helped people to set up their equipment for hot-dogging.

A misguided modeler attempts a nose-in hover!



Novice heli pilot Chris Chianelli (left) flies as Tim coaches.

Before the qualifying round, Curtis—1993 U.S. national champion and newly crowned world champion because of his incredible victory in Austria—gave us a sample of what makes him so good. His backward-rolling figure-8s and backward pirouetting loops were only exceeded by his famous death spiral and backward-flipping autorotation. If you ever see this young man fly, you won't forget it.

Chris Chianelli and Tim DiPeri with a Hirobo Shuttle.

The midday festivities also included a very exciting full-size military helicopter demonstration—an AH1S Cobra and an OH6A Loach—by the U.S. National Guard. Later, spectators were allowed a close look.

WINNERS

POS.	PILOT	HELI	ENGINE	FUEL
1	C. Hiatt	X-Cell	O.S.	Morgan 30%
2	T. Dooley	Hirobo Eagle Ex	Y.S.	Morgan 30%
3	R. St. Onge	Schluter Futura	O.S.	Morgan 30%
4	M. Mas	Hirobo Eagle	O.S.	Byron
5	N. Muraki	Hirobo Eagle Ex	Y.S.	Morgan 30%
6	T. DiPeri	Hirobo Eagle	Y.S.	Morgan 30%

All pilots used the Futaba 9zhp radio for this event.

Altech Marketing employees and their families were appointed chefs for the weekend. With their cooking and Altech manager Gabe Mastriano's determination that everyone would have a good time, there was little that could go wrong.

Tom Dooley is helped by Hirobo executive Mr. Kuni.

Officially, Horace Hagen directed the contest. Once again, Tom Unger and his colleagues—Tom McAteer, John D'Arcangelo and Barry Wehrung (aided by Curtis Youngblood)—provided fair (sometimes *brutally,* for me!) high-quality judging throughout the event. This wasn't the first time I had flown in front of them, and they're always consistently good.

In round 1, everyone flew well. Most memorable is Cliff Hiatt's nearly perfect round. He lost points on only one maneuver: during the top hat, his pirouettes were both in the same direction (instead of in opposite directions), so his score for that maneuver was zero, and Tom Dooley took top honors for the first round.

▶ **Day 2—Sunday.** It was all business for the competitors. Once again, the weather was excellent, and we were all able to fly three rounds. (See the chart for information on the top six fliers and their equipment.)

During the lunch break (again, free, courtesy of Altech), we were treated to demo flights of the Hirobo ParaPlane. I even had a chance to fly it; it's incredibly easy to fly and pleasing to the eye.

Awards were presented in the early afternoon. Cliff Hiatt took top FAI honors, and as the top Hirobo pilot, Tom Dooley later went to Japan to compete against the world's finest. He finished in second place; congratulations, Tom!

So it's hats off to Altech Marketing. Events of this size require tremendous effort, planning and dollars. It's refreshing to see a company taking such a sincere interest in an event. Don't miss this event next year. ■

JET BLAST

GEORGE LEU

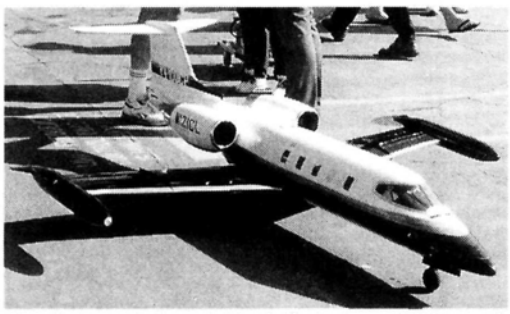
SCALE WHEELS AND QUIET MODELS

AS RECENTLY as eight years ago, jets were virtually nonexistent at major flying meets. There were always one or two enthusiasts who did well and kept the jet movement alive, but they were the exception rather than the rule.

Today, jets are a major factor in competition flying. I've just returned from the 1993 Scale Masters Championship at Mile Square Park in Fountain Valley, CA. Seven of the 45 contestants flew jet aircraft, and four of these finished among the top eight. Flying a Mark Frankel-designed Lear Jet, Dennis Crooks took first; Terry Nitsch flew his Bob Violett F-86 to second; and Shalesh Patel (Yellow Aircraft F-14 Tomcat) and Lee Rice (Lyn McCauley-designed F-104) finished fourth and eighth, respectively. I was very pleased to see these standings because they reflect what good scale subjects jet models have become.

PHOTO BY RICH UBAYTICH

Shalesh Patel's F-14 TomCat at the Scale Masters.



Dennis Crook's Lear jet took first place at this year's Scale Masters.

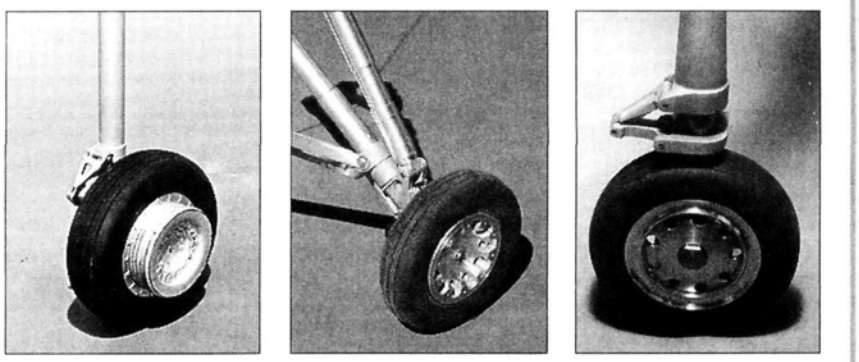
I'm sure that the four scale enthusiasts mentioned would all agree that increased reliability with regard to engine performance, landing-gear systems, fan units, airframes, etc., has helped make jet flying a successful venture for them. I salute their dedication and success at the prestigious Scale Masters Championship.

AEROLOFT DESIGNS

To most Top Gun and Scale Masters contestants, Aeroloft Designs* has been known for years as *the* custom-graphics manufacturer. Before being released, their designs are documented, engineered and produced to customers' specific requirements—and Aeroloft's high standards. (For a complete list of their graphics, see the Aeroloft 1994 catalogue.)

The company recently ventured into the ducted-fan marketplace and now offers many new products and designs for ducted-fan enthusiasts. Owner Steve Slachta says, "I've built and flown jets for many years—and applied our graphics for display purposes. While people have always liked our graphics, I noticed they were interested in the jet aircraft and accessories I had acquired through international travel. One thing led to another, and I started to import various lines of jet-model products for sale in the USA. I'm thrilled with the success of our lines, and I will continue to add to it for all U.S. jet modelers."

One of Steve's most successful lines of kits and accessories comes from Trim Aircraft in Australia. Trim Aircraft makes the popular Ramtec fan unit. With its nine-rotor-blade, 10-stator-blade setup, the Ramtec has enough pitch to keep rpm down without incurring any loss of performance. The Ramtec accepts most popular fan engines, including O.S. .65, .77 and .91, Rossi .90, K&B .82, KBV .82, and Picco .80, .90. The Ramtec has a 5¼-inch-diameter shroud, but it can be ordered



These are just a few of Glennis Aircraft's scale wheels, all of which are custom-made and exactly to scale. Left—an F-86 wheel; center—a wheel for an F-16; right—one for an F-4.

with a shroud that has been machined to fit current, U.S., 5-inch-nominal-diameter fan setups. If you think that a blade with a higher pitch might improve performance while reducing rpm, you can order a replacement impeller blade. (Replacements are available for almost all current U.S. ducted fans.)

Aeroloft Design imports many jet products, including this Ramtec ducted-fan system, which is made by Trim Aircraft in Australia.

Trim Aircraft also makes a Spectre sport/speed aircraft and a scale F-20 Tigershark. Both have epoxy/glass fuselages that have been reinforced with carbon-fiber in areas of flight stress. They're designed around the Ramtec fan unit and have efficient ducting systems without cheater holes.

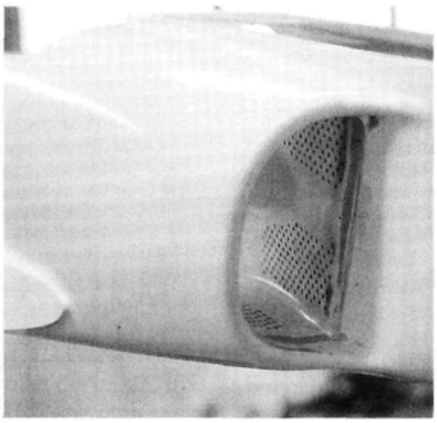
Steve is also thrilled about being the exclusive U.S. importer of the Philip Avonds single-engine F-15 and Rafale scale kits. The F-15 is a simplified, less expensive version of the two-time world champion aircraft flown by Philip Avonds. The kits are made in Europe and reflect a marked degree of "old-world" quality. For more information on the entire Aeroloft product line, contact Steve.

GLENNIS AIRCRAFT

One of the most challenging areas of any scale modeling is coming up with the correct hubs and tires for your scale aircraft, and there are many intricate tire/hub designs for jets.

I've always been resourceful enough to modify a set of scale tires and come pretty close to making something that looks like the full-size tire/hub I want to replicate. (The tires I used for the YF-22 "Field & Bench Review" in this issue are modified Robart* scale products.) But today's high contest standards are making it very difficult to get by with modified tires; you need *exact* scale wheels and tires, such as those made by Glennis Aircraft*. Many Scale Masters contestants, including Shalesh Patel, used Glennis Aircraft custom wheel/hub units.

Each set of hubs is custom-machined out of aluminum bar stock, and each tire is individually molded out of hard rubber compounds. Details such as tread and intricate hub design are added on an individual basis to suit each customer's needs. Each set of Glennis wheels and tires takes about four weeks to make. If you have questions about tires, call them; they have a documentation library that will help you find specific tire/hub designs for many aircraft.

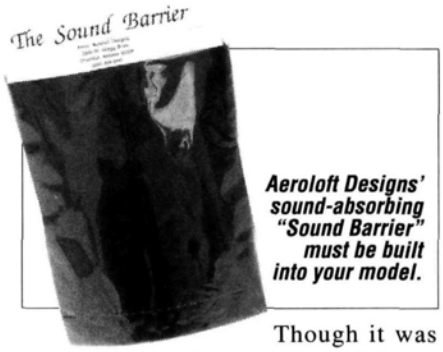


The Bob Violett Models Hush Kit quiets jet air-intake sound. It was designed for use with BVM models, but it can also be used with others. You must build it into your model during its construction.

NOISE REDUCTION

As we head into the building season, I think it's important to discuss ideas for noise reduction—ones that you can incorporate as you construct a jet model. Most jet noise comes from the inlet; by carefully adding sound insulation, you can reduce this noise.

A useful item in this regard is the Bob Violett Models* (BVM) Hush Kit.



Aeroloft Designs' sound-absorbing "Sound Barrier" must be built into your model.

Though it was initially designed for BVM aircraft, the kit can be used with any aircraft. The catch? You must install it while you're building your jet, because some drilling and fitting is required to position the sound-proofing materials properly. Sophisticated sound-testing equipment has recorded reductions of as much as 4dB.

Aeroloft Designs' Sound Barrier is a ½- or ¼-inch-thick composite material that absorbs noise. No kit is available, so this material may be installed at your discretion, along the inlet, from the intake to the carburetor. It's sold by the square foot and has a permanent adhesive backing.

My last idea was provided by Mike Cherry, editor of *R/C Jet International*. It involves a visit to the radio/stereo store to buy the acoustic foam that's packed inside speaker boxes. Apparently, this light material absorbs sound and can be shaped to fit into very tight spaces. Mike says it isn't expensive—a factor that may appeal to many modelers. But if the foam isn't fuelproof, it may absorb oil and add weight to your plane.

Minimizing sound is important to us all. If you have a good idea on the subject, let me know, and I'll pass along the information. Send your suggestions to "Jet Blast," *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897.

**Here are the addresses of the companies that are mentioned in this article:*
Aeroloft Designs, *2940 W. Gregg Dr., Chandler, AZ 85224; (602) 838-0447.*
Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174; (708) 584-7616.*
Glennis Aircraft, *5528 Arboga Rd., Linda, CA 95901; (916) 742-3957.*
Bob Violett Models, *170 State Rd. 419, Winter Springs, FL 32708.* ■

ELECTRICS

(Continued from page 101)

4041 and the 4043 should handle up to 1,000 watts.

So, there you have it. Gear up and fly high, wide and fast! You can write to me at: Mitch Poling, 601 Med. Sqn., PSC 10 Box 1908, APO AE 09130. A 29-cent stamp will get a letter here by first-class mail.

**Here are the addresses of the companies mentioned in this article:*
***Model Electronics Co.,** 6500 Sixth Ave. N.W., Seattle, WA 98117; (206) 782-7458.*
***Sonic Tronics Inc.,** 7865 Mill Rd., Elkins Park, PA 19117.*
***DuraTrax/Great Planes Model Distributors,** P.O. Box 9021, Champaign, IL 61826.*
***Modellbau-Technik Kruse,** Rechberghauserstr. 57, 73035 Goppingen, Germany; 011-49-7161-12873.*
***Graupner;** distributed by Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027.*
***Ludwig Feinmechanik,** Robert-Hooke Str. 8, 28359 Bremen, Germany; 011-49-421-211111.*
***Astro Flight Inc.,** 13311 Beach Ave., Marina Del Rey, CA 90292.* ■

F-15

(Continued from page 48)

learned a very useful technique for bending sheet balsa around curved formers without cracking the balsa. The trick is to stick several strips of strapping tape to the outside, concave surface of the balsa before you wet it. (I just use water.)

The nose section is made of ¼-inch balsa blocks that have to be carved and sanded to shape. The blocks are not identified by part number, so you have to study the photos carefully to make sure you get the right blocks in the right places. To ensure a good fit and proper alignment, a plywood spinner ring is temporarily glued to the spinner backplate with 1/16-inch balsa spacers between them. The backplate is then attached to the engine and the ¼-inch balsa blocks glued into place. (To allow room for final sanding, the spinner ring is approximately 1/16 inch larger in diameter

(Continued on page 120)

CENTER ON LIFT

MICHAEL LACHOWSKI

L.S.F. NATS

THE WEEK OF August 7 to 14 was perfect for the League of Silent Flight (LSF) National Championships. More than 100 pilots competed in nine different soaring events. The competition was excellent, and the man-on-man contest format kept shuffling the leader board all week.

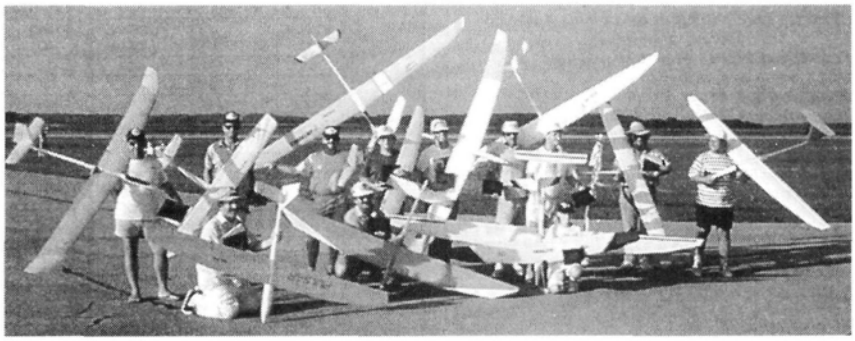
Most pilots flew the thermal duration events: 2-Meter, Standard and Unlimited Classes. There was also a variety of other soaring events, including F3J Hand-Tow, F3B Multi-Task, Hand-Launch, Sportsman Multi-Task and Cross-Country. For evening entertainment, there were two days of 9-hole, hand-launch golf and the banquet.

Tony Matyi launches his 2-Meter Probette. He placed second in 2-Meter and first in Standard. Josh Glaab (right)—the 2-Meter champion and overall champion—is doing the timing.

Through the efforts of Gil Gaugher, LSF secured the Mid-America Air Center in Lawrenceville, IL—the site of three recent AMA Nationals. The runway surfaces and the fields surrounding the site proved to be an excellent source of lift. The weather cooperated at the beginning of the week. Only on Thursday did rain force the postponement of the Unlimited Class for one day.

MAN-ON-MAN COMPETITION

Most of the contest events were man-on-man competition where scores were adjusted to the best flight score in the flight group. Group scoring avoids the problem of poor lift conditions early or late in the day, and it adds interest when a flier ventures off and gets the only maximum score in the group.



Winners in Unlimited. Rusty Shaw (standing fourth from left) topped them all with his a 2-Meter Scorpion.

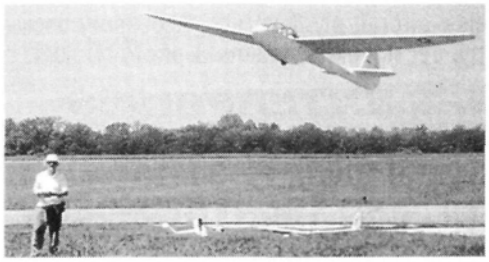
Charles Baltzer developed a great program that organizes the flight groups so that pilots are always flying against a different set of competitors in every round. For the AMA thermal events, flight groups consisting of eight pilots were common, and 10 winches were available in case of problems. By the end of the week, I'm sure that everyone knew where Luther Mitchell's well-equipped truck was. His help in rebuilding some of the winches contributed to the program's success.

THERMAL DURATION EVENTS

The main events for the week were the three Thermal Duration classes. Flight tasks changed each round. The plan was for durations of 6, 6, 10, 10, and 8 minutes and a 25-foot runway landing for the first three rounds, changing to a challenging 5-foot, 100-point tape for the remaining rounds. The 2-Meter event ran smoothly, and all five rounds were completed, but the Standard class started slowly and resulted in only four rounds.

I can speak from experience that being at the top of the leader board in the early rounds was bad luck in all three events. The longer flight durations in the last three rounds and the 5-foot tape resulted in some competitors getting blown away because of short flights, while another pilot in the group obtained a 10-minute maximum. The 2-Meter winner was Josh Glaab, who flew a Waco Two. He definitely benefited from the man-on-man format with a flight of only 4:15 minutes in a 10-minute round that was good enough for 934 out of 1,000 points. The Standard class winner, Tony Matyi, flew a Probette 2-meter. (He wore a T-shirt that said "Ban 2-meter.") An excellent 75-point landing on the 5-foot tape clinched first place for Tony. A 75-point landing doesn't sound impressive, but it is a 96 on a regular 25-foot tape. Many of the Standard class pilots flew 2-meter designs, which makes you wonder why we still even fly Standard. If we dropped Standard, we could fly 1½ days per class and complete seven to eight rounds.

To fly five rounds in Unlimited, the tasks were reduced to two 5-minute and three 8-minute flights. The runway scoring in Unlimited together with



Don Goughnour flies his Pratt-Read on a beautiful ROG from the runway.

shorter maximum times and higher-performance sailplanes, produced some tight competition. Rusty Shaw was the winner, flying a 2-meter Scorpion. With the short flight times, a 2-meter scored high because it was easier to land. Three pilots tied for second: Fred Weaver, Jim Thomas and Josh Glaab. They provided a good show in the three-way flyoff for second place and finished in the order listed above.

Prepping the winches for another flight group. There were enough winches for a group of eight plus spares, in case of problems. Retrieval was done using golf carts. The Jr./Sr. competitors helped by doing most of the retrievals.

Many pilots flew 2-meter designs in several classes, and no single design dominated the field. Unlimited had just as much variety in design. Interestingly, the winners in all three thermal classes were 2-meter designs! This included Rusty Shaw's single day, best-performance award for his Unlimited win. It was an excellent week for the Waco Factory Team, with Josh Glaab taking the award for the best overall score. Josh and team members Frank Weston and Jack Cash put together the best collection of scores to take the team trophy. They were flying Weston Aerodesign models, including the Waco Two, the Waco Three and the Magic

Rich Burnoski Jr, placed fifth in F3J. His father kept track of the competition.

HAND-LAUNCH

The weather was perfect for hand-launch. The heat and humidity were not excessive, and the wind was light. Reading the air was challenging because of the light wind. Often, there were several thermals in the flight area at the same time. Some of these thermals would interact and change direction several times during a flight. Since we were flying in the middle of an open field, there was no single spot where thermals would break loose. Mike Fox and Rusty Shaw bested the field with excellent launches while flying Pitchmoths. They

Gil Gaugher demonstrates his launch technique. He was instrumental in obtaining the Mid-America Air Center and the golf course for Hand-Launch Golf.

WINNERS

F3J

Place	Pilot	Model
1	Mike Fox	Viper
2	Mike Lachowski	Aeolus F3J
3	Rusty Shaw	Scorpion
4	Jerry Banister	Riser 2M

F3B

1	Mike Lachowski	Aeolus F3B2
2	Dennis Phelan	Comet 89T
3	Fred Weaver	Swift
4	Rich Burnoski	Original design

SCALE

1	Bernie Coleman	
2	Rich Burnoski	
3	Don Goughner	

X/C

1	Pat Flynn	

SMT

1	John Gunsaullus	

HAND-LAUNCH

1	Mike Fox	Pitchmoth
2	Rusty Shaw	Pitchmoth
3	Bob Massman	Monarch
4	Jerry Shape	Monarch
5	Paul Carlson	Micro Spirit

2-METER

1	Josh Glaab	Waco Two
2	Tony Matyi	Probette
3	Don Harris	Mod. Gentle Lady
4	John Richter	no data
5	Rusty Shaw	Scorpion
6	Mike Lachowski	Aeolus 2M
7	Rick Lake	Duck
8	Mike Stump	Merganzer
9	Charlie Fox	no data

STANDARD

1	Tony Matyi	Probette
2	Bob Sowder	Falcon 800
3	Fred Weaver	Swift
4	Frank Weston	Waco
5	Rusty Shaw	Scorpion
6	Mike Fox	Scorpion
7	Cal Posthuma	Duck
8	Rick Lake	Duck
9	Dale Nutter	Std Duck
10	Jay Schulltz	Sagitta 900

UNLIMITED

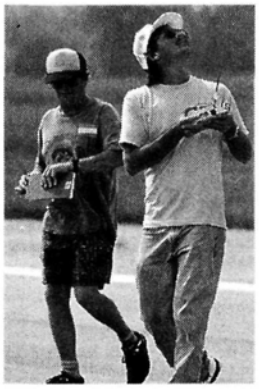
1	Rusty Shaw	Scorpion
2	Fred Weaver	Thermal Eagle
3	Jim Thomas	Shadow
4	Josh Glaab	Magic
5	Rich Burnoski	Galactica
6	Frank Weston	Magic
7	Paul Carlson	Therminator
8	Brian Smith	Pulsar
9	Mike Stump	Swan
10	Mike Lachowski	Aeolus F3J
11	Ken Bates	no data

were followed by Bob Massman and Jerry Shape, who were piloting Monarchs.

F3J HAND TOW

The soaring week began with F3J Hand Tow. This included the best lift conditions for the week with light winds, low humidity and comfortable temperatures. The biggest problem at the start of the day was towing in almost no wind. Only a few pilots brought pulleys for towing. When the end of the line has been staked, the tow person runs with the pulley, and this doubles the speed of the tow. With a small, light, 2-meter, towing takes as little as 10 seconds to full launch height.

After seeing tows with pulleys, some competitors resorted to using winch turnarounds to try to keep up with other members of the flight group. Getting launched quickly was important with the excellent lift conditions as flight times of 10 minutes were common. We're still learning what F3J is all about, so the rules weren't followed precisely. The fly-off rounds were eliminated, and later in the afternoon, some of the flight groups were as small as three pilots. With six rounds of competition, this event was one of the most enjoyable.



Hand-Launch winner Mike Fox completes another max flight while Rusty Shaw counts down the time.

F3B AND SPORTSMAN MULTI-TASK

F3B was the second event of the contest. The light winds from F3J remained, but the lift was gone. Flight groups of four pilots meant two pilots from the same team were often competing together. This kept the pilots and the team members busy all day. All the F3B pilots appreciated the help from the fliers who were waiting to compete in other events. They helped as officials at base A and B. When there were some problems with the signaling system the LSF planned to use, Dennis Phelan saved the day by providing an excellent signaling system for the contest. The light and variable winds greatly reduced launch height and ballast, so speed times were on the slow side through the three rounds of competition. It also resulted in some short-distance flights. In the end, I was able to enjoy my first F3B victory with no bad flights in three rounds.

SMT (Sportsman Multi-Task) was pushed back into Cross-Country day by the Unlimited Class rain delay. Fortunately, there were no frequency conflicts between SMT and Cross-Country. The size of the field was reduced, since many pilots had to return home. Since LSF had the Mid-America Air Center through Friday, O'Neill Airport had to be used. John Gunsaullus topped the field in the high heat and humidity.

Two-Meter champion Josh Glaab (standing third from left) flies a Waco 2. LSF president Mike Stump (standing left) holds his trophy high.

CROSS-COUNTRY

Ten teams competed in Cross-Country. Several of the local fliers helped by providing chase vehicles for some of the out-of-town fliers. Thermal activity was weak in the high humidity, but a few pilots managed to make it around the course. The first few miles occurred over cornfields, which was not much help if you dropped too low. Several pilots spent long periods at one place trying to find lift strong enough to continue on the course. Pat Flinn was the first to finish and the eventual winner.

GOLF

This year, we were able to play the front nine and back nine of the Fox Hollow golf course. Several pilots came out armed with airplanes and the best golf carts they could pick to try to set new course records. Somehow the pilots who just came out to fly seemed to have the most fun. Mark Nankivil put in the best round on the front nine while some other pilots explored alternate ways to fly, including using a launcher on the tee while the pilot was standing on the green. On the second day of golf, Frank Weston surprised the whole field with this alternate approach and a spoileron-equipped model that was perfect for getting holes in one. The Waco 434 may not be the best thermal HLG, but it sure is good at golf. With a good launcher, I think it's possible to get below 15 for nine holes and maybe even a nine, given the right conditions. On the other

(Continued on page 127)

The winners of the Hand-Launch class. Mike Fox (center) came out on top in HLG, flying a Pitchmoth. The field was dominated by Pitchmoths (left and center) and Monarchs (two on right).

F-15

(Continued from page 120)

canopy/turtle deck, I used Coverite's* 21st Century aluminum spray paint, applied to the inside surface. The match is quite good.

The kit includes an extensive decal sheet so you can trim the model the way the prototype was done. But you have to study the photos on the box carefully to determine where to place the decals. The decal sheet did not include the "USAF" or "01593" shown on the fins. I used rub-on lettering and numbers to make these markings.

The missiles and bombs supplied with the optional armament package are made of balsa and come primed with a white primer. I left the missiles white, but painted their tips red; I painted the bombs black and gave them yellow tips. I used striping tape to add those final touches. The instructions show how to make the missiles releasable, but I chose to attach them permanently to the fuse with ⅛-inch dowels and short standoffs made of fuel tubing. The bomb pylons were attached to the wing with 1/16-inch double-sided tape. The armament weighs 5 ounces when complete.

BALANCE

I added 4 ounces of lead just behind the receiver battery (which is in the aft section of the plane) to get the plane to balance within the prescribed range. As it was, the CG ended up at the fowardmost end of the range.

CONCLUSION

The F-15 Eagle is a fine-looking, high-performance airplane that is easy to build and fun to fly. The plans and instruction book are very well-done and guide the builder every step of the way. I highly recommend this kit for those who want jet-like performance without the complexity and cost of a ducted fan. If you're contemplating building a jet-like sport plane and are considering one of the three offered by Great Planes, I recommend that you start with this one.

**Here are the addresses of the companies mentioned in this article:*
Great Planes Model Mfg. Co., *P.O. Box 788, Urbana, IL 61801.*
Pacer Technology & Research, *9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*
Top Flite Models; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.* ■

CENTER ON LIFT

(Continued from page 118)

hand, going out and flying down a golf course is just plain fun. Let's stop keeping score.

BANQUET

The banquet was held on Thursday evening after the Unlimited soaring had been rained

(Continued on page 128)

CENTER ON LIFT

(Continued from page 127)

out. Many awards were presented, and there was a raffle for all the workers. Everyone who helped during the contest was entered in a raffle for which a terrific bunch of prizes were donated by manufacturers. There were enough prizes for everyone to walk away with something. The raffle prizes were a great incentive to get folks to help run the contest. Unfortunately, the rain delay delayed the high point awards and team trophies until after Friday's competition.

SUMMARY

The LSF Nationals were a great success. It has become the best week of soaring in the U.S. Some of the organizers think that they can make it even better and fly even more rounds! I hope to see you all at next year's LSF Nationals. ■

RPM

(Continued from page 60)

prop for our combination: the APC* 9.5x8N. This propeller proved best for straight-line speed (83.3mph), turning 13,750rpm. It also had the best speed through a loop, at 43.5mph and 13,430rpm.

Running a close second was the APC 9.5x8.5, operating at 99.4 percent of the 9x8's speed on the straight and 98.6 percent of the 9x8's speed in the loop. The data shows a considerable drop-off as the diameters increased to 10 and 11 inches, respectively. I was a bit surprised that the APC 11x7 didn't do better in the loop because its loop rpm (10,600) placed it very close to the maximum torque. Similar observations were made for the Rev-Up* and Master Airscrew* 11x7s. Frank Vassallo noted that a 10½ inch diameter with an 8 inch pitch might be just what was needed to improve loop performance. A cut-down APC 11x8 might do the job. Looking again at our number-one performance prop, we can see that on the straight while turning 13,750rpm; this translates to about 1.1b.hp, or within about 8 percent of peak power available. Conversely, the APC 9.5x8N passed through loops at 43.5mph at 13,430rpm; this translates to about 76 oz.-in., or about 84 percent of the maximum available torque (90 oz.-in.).

The 9.5-inch-diameter props were really fun to fly, while the 11-inch-diameter propellers were...ah...dogs—very poor performance. It wasn't the propeller's fault; you simply must learn to match the engine, airplane and propeller to give the best possible combination. Any two factors without the third is mere speculation. Do you understand that, you "other" engine

(Continued on page 137)

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FIRST ANNUAL GATOR SHOOTOUT at the R/C World flying site in Orlando, FL. If you want to enjoy world-class scale competition, join us the weekend of January 14 through 16, 1994. Forty of the best scale builders and fliers have been invited to compete. Wally Zober and Dixie Cutrone are contest directors. Need accommodations? The **R/C World condos** are available for a super R/C and Disneyworld vacation, but they *must* be reserved *in advance*. Contact Lonie Charlson, (407) 380-6359. [2/94]

R/C WORLD ORLANDO, FL, CONDO RENTAL: 2 bedroom, furnished. Available weekly or monthly. Low rates. 100-acre flying field with enclosed hangars. Close to Disney World and Epcot Center. For information, please call or write to R/C World, 1302 Stearman Ct., Orlando, FL 32825; (407) 380-6359.

WANTED: model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [6/94]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

WANTED: *model-airplane engines and model race cars made before 1950.* Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/94]

LOCKHEED P-38 LIGHTNING—Are you a P-38 Lightning fan?—R/C models or full-size? Join the P-38 Model Organization International! For more information, send $1 to the P-38 Model Organization International, Medelbyvej 54, 2610 Rodovre, Copenhagen, Denmark. [2/94]

MISSILE SECRETS—engines, rockets, U-build. $2. Northtech-A5, 813 Cherry Ave., Albany, GA 31710

WANTED: old engine parts, misc. junk before 1970. Wesley Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003. [7/94]

R/C FLIERS' DREAM COME TRUE. Vacation with your family, and bring your R/C plane! R/C World is a radio-control community with beautifully furnished condo (pool, tennis included), and one of the world's finest flying sites. All this only 20-30 minutes from Disney, Epcot, Universal Studios, Seaworld, and about 1 hour to Kennedy Space Center. For more information, call or write to Dave Patrick, P.O. Box 1385, Oak Park, IL 60304. (708) 771-6697. [1/94]

CLEVELAND KITS (AND PLANS) WANTED: Immediate cash, call or ship for offer. Ship to Jay Herbert, P.O. Box 1286, Mattituck, NY 11952. Phone (516) 298-4135 or fax (516) 298-4181. [3/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGE:100 pages–timers, needle valves, orginal cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 post-paid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [2/94]

MAGAZINE BACK ISSUES—Flying Aces, Model Airplane News, Air Trails, 1930s and '40s. FM, RCM and more. Send SASE for list to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [2/94]

IMPORTED DIESEL ENGINES—world's best selection: AE, AM, Aurora, Cipolla, KMD, MAP3, Mikro, MK-17, MVVS, Modela, PAW, Pfeffer, Letmo and USE diesels, plus very special imported glow engines, CO_2 motors and sailplane kits. Ten-page catalogue—$1. Carlson Engine Imports, 814 E. Marconi, Phoenix, AZ 85022-3112. [2/94]

SCALE WW I Plans: Send $1 for current list. "Smileys," 23 Riverbend Rd., Newmarket, NH 0385 [2/94]

NEW ZEALAND AERO PRODUCTS—Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Fiberglass parts; hardware packs; timber packs; color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03)2128192.

FREE—Tesla turbine plans. Contact Dan, 1214 N, 6th St., Port Hueneme, CA 93041. [2/94]

WANTED—Kraft KP-4/6 from 1964-66. Karlheinz Schmid, Stieranger 7, 8900 Augsburg 21, Germany. [2/94]

PARACHUTIST! Release a scale-like parachutist! A real crowd pleaser and a lot of fun! For a brochure and jump contest rules, SASE: Hobby Hut Mfg., 2040 W. 21st St. N., Suite #77, Dept. MAN, Wichita, KS 67203 [3/94]

QUIET YOUR ENGINE with Koosh-In-It—a flexible, rubber-fabric laminate that "softens" engine vibration. Install it between the engine, engine mount and/or firewall. Pad measures $2\frac{1}{2}$x4 inches and is $\frac{1}{16}$ inch thick, and it can be cut easily with blade or scissors. Only $5.80, postage-paid. Balsadust, P.O. Box 078, New York, NY 10021-0078; (212) 737-0071. [3/94]

WRENCHES AND GASKETS for vintage and newer engines Bob McCord 325 Sylvan Mountain View, CA 94041. [3/94]

SCALE DOCUMENTATION-MODEL PLANS—Drawings, photo packs, monographs, unusual aircraft. Illustrated catalogue: $2 (post-paid). Bill Young, 8106 Teesdale, N. Hollywood, CA 91605. [4/94

HELICOPTER SCHOOL—five days of hands-on instruction with X-Cell helicopters and Futuba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 300 satisfied students and 10,000 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (800) 452-1677. Outside USA: (904) 698-4275, or fax (904) 698-4724. [3/94]

FOUR 1993 SCALE CATALOGUES. SPPS super-scale plans; SPPS scale documentation; ASP scale plans handbook; ASP aircraft scale drawings handbook (three-views). Catalogue—$5 (overseas airmail, add $5 for one to four catalogues); 140 different scale plans; 120,000 photos; Visa/MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. [4/94]

ANTIQUE AIRPLANE PRINTS, 8x10 color prints. Stearman, Gee Bee, Waco, Jenny, P.T. Ryan; 10 in all. Send $1 (refundable) for color brochure. Robert Kohr, P.O. Box 204, York, PA 17405. [5/94]

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). *Specify needs. Send SASE and 60 cents for list.* Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

OLD MODEL MAGAZINES. Send SASE for list to Dave Bessel, P.O. Box 669, Poway, CA 92074 [2/94]

PAYING $50 each for toy metal outboard boat motors. Oliver, Evinrude, Johnson, Gale, Wen-Mac, Sea-Fury, etc. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684; (616) 941-2111. [5/94]

THE TOOL RESOURCE has the right tool for the right job—the finest quality hand tools, soldering equipment, tool bags, etc., specifically for hobbyists, technicians, service professionals. Current catalogues available. Write: The Tool Resource, Dept. MA, P.O. Box 1106, W. Dundee, IL 60118; fax (708) 468-0849. [2/94]

WANTED: full-size Monogram catalogues. Quantity, year, condition, price (each), shipping charges and daytime phone number (first correspondence). John Bickett, P.O. Box 38383, Colorado Springs, CO, 80937-8383. [2/94]

CUSTOM KIT BUILDING. Will build most kits from trainers to quarter scale; 20 years experience. Write for quotes: Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [2/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [11/94]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [5/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [11/94]

CUSTOM-BUILT MODELS: 17 years experience. Will build your R/C project. Quality craftsmanship, reasonable rates, satisfaction guaranteed. Specializing in ducted fan and giant scale. Giant Scale Models, 1603 N. Main St., Ste. E, Anderson, SC 29621; (803) 224-0797; fax (803) 225-4465. [2/94]

WANTED—control-line profile kits: Midwest P-63, Skyraider, P-51, ME-109, Sterling Navion, Starfire, Skyshark, P-40, Sportster. Throttles: Rotovalve, Dynamic 19/60, McCoy 19/35 RD/BL, K&B 19/35 grn. Engines: McCoy 19/35 R/C RD/BL, three-line bellcranks. Paul Patterer, 114 Mosher Ave., Battle Creek, MI 49017; (616) 965-5364. [2/94]

ENGINES: IGNITION, GLOW, DIESEL—*new, used, collectors, runners.* Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [5/94]

ARE YOU TIRED OF PAYING $1.29 for six screws? For a *free* catalogue and price list of screws, nuts, locknuts, blind nuts and more, in sizes from 0-80 to 1/4 inch, contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (800) 892-6917; fax (908) 788-2607. [5/94]

R/C COMPOSITES—Example: carbon fiber, 100' 0.25" by 0.007" tow—$5.75, postage-paid; send SASE for example applications sheet, free samples and price list to R/C Composites, P.O. Box 832, Newark DE 19715. [2/94]

SCALE AIRCRAFT DOCUMENTATION and RESOURCE GUIDE. World's largest commercial collection. Over 5,000 different color Foto-Paaks and more than 22,000 three-views; 152-page resource guide/catalogue—$6; Canada—$7; foreign—$12. Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [2/94]

MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [3/94]

FOR SALE: Custom-built Python 120 pattern plane with retracts and plug-in wings and stab. Brand-new—$1,200. Also Yellow F-4 Phantom with new O.S. 91 and Dynamax, six Futaba B.B. servos and Spring Air retracts; custom paint finish—$1,500. Jack Bielecki (403) 239-6181. [2/94]

FOR SALE: Ignition engines, all pre-1950. Send large SASE: Leonard Roberts, 3819 Lydon Lane, Moosic, PA 18507; (717) 961-2357. [3/94]

FOR SALE: 5.8 Sachs engine (single-cylinder, 2-cycle, 10hp). Brand-new—$495. 2315 Mahoning Rd., N.E.#1, Canyon, OH 44705-1913. [2/94]

STOP ENDLESS SEARCHING—R/C magazines as references you need to finish projects. Model-Base—a comprehensive database of R/C articles from major magazines—puts the information at your fingertips. A user-friendly, expandable database, Model-Base runs on IBM-PCs and compatibles (80286 or above). EGA/VGA graphics recommended. For your Model-Base demo, send $5 to TFH Software, Dept. MAN, P.O. Box 765, Collegedale, TN 37315. Specify 3.5 or 5.25. First 50 demo requests get $10 off the complete software package. For information only, send long SASE. [2/94]

FOUR 1993 SCALE CATALOGUES—SPPS *super-scale plans*, SPPS scale handbook, ASP aircraft drawings handbook (three-views). Catalogues—$5 each. Overseas airmail—add $5, 1 to 4 catalogues; 140 different scale plans; 120,000 photos. Visa/MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239. [4/94]

SCALE PLANS—1900 to WW I, "peanut to 100." For illustrated catalogue, send $1 to Smileys, 23 Riverbend, Newmarket, NH 03857. [7/94]

NEEDED: U-reely, U-control handle—top prices! G. Fierce, N. 6015 Elm St., Spokane, WA 99205; (509) 325-1045. [3/94]

CUSTOM-CUT PARTS from your plan. Call Dr. Little: (410) 889-3963—leave message. [2/94]

WANTED: Guillow's discontinued Fieseler Storch kit no. 304; any discontinued WW I or WW II stick-and-tissue free-flight scale kits. Collector will pay top prices. George Santikian, 7285 N. Channin, Fresno, CA 93711; (209) 439-3363. [2/94]

WANTED TO BUY: original kit form, circa 1968 to 1970, "Schoolgirl" by Top Flight. Barbara Blythe, 2227 N. Fremont St., Monterey, CA 93940; (408) 372-7586. [4/94]

NEW TO RC?—booklet: "Selecting, Building, Flying Your *First* Radio Model"—$4, including postage. Dr. Little, #1 E. University Pkwy., #209, Baltimore, MD 21218. [2/94]

WANTED: Sterling discontinued Ansaldo SVA5 kit no. A-18; Spad XIII kit no. A-21; Guillow's discontinued Pfaltz D-3 kit. Collector will pay top prices. George Santikian, 7285 N. Channing, Fresno, CA 93711; (209) 439-3363. [2/94]

CUSTOM AIRCRAFT—a full-scale sport-aircraft component company (RV-3, RV-4, RV-6) now offers custom model airplane kit construction. Please write or call for price quotes; please include telephone number. Address inquires to Herbert Ross, c/o Custom Aircraft, Payson Airport, 900 W. Airport Rd., Ste. 9, Payson, AZ 85541; (602) 476-3062 (evenings). [2/94]

PLANS WANTED: originals from '30s, '40s, '50s and '60s; model airplane kits; CL, FF and rubber-powered. Jim Wesch, RR 3, Box 76, Centerville, IA 52544. [4/94]

R/C SKYDIVING—illustrated catalogue: $1. R/C Skydivers, Box 662N, St. Croix Falls, WI 54024. [7/94]

FOR SALE: fiberglass B-17, B-25, B-26—molds and parts. Everything must go! Asking $3,500. Call Don at (407) 676-4123. 5/94]

VANISH FROM POLICE RADAR! Legal jammers defeat radar and laser speed guns. Brochure— (800) 451-4477. [4/94]

GRAPHITE FILAMENT FIBER: increase strength and reduce weight. Graphite or graphite-Kevlar hybrid—1-pound, 5,000-foot spool: $24 (ppd). Send SASE for sample. Coyote, Box 1006, Huntsville, AL 35807. [4/94]

R/C SWAP MEET in your living room! Nationwide buy/sell/trade newsletter with fast circulation. Free sample copy. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521. [3/94]

SCALE DOCUMENTATION—plans enlarging. Four new 1994 catalogues. SPPS superscale plans; SPPS 130,000 documentation photos; ARGUS Scale Plans Handbook; ARGUS Aircraft Scale Drawings Handbook (three-veiws). Catalogues—$5 each (ppd, USA & Canada; overseas airmail, add $5 each). SASE for plan enlarging info. Visa/MC. Jim Pepino's Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; phone/fax (910) 292-5239. [2/94]

PROMOTION—free biplane sport-scale plans. Send address: Sibille Concept, 272 Royal, Gatineau, Quebec, Canada J8T 8E5. [4/94]

FOR SALE: Avons F-15 kit—new; in box: $450; R/C kits F7 Tigercat. Call (314) 843-7126. [3/94]

by JEF RASKIN

THE SCHNEIDER SPORT ELECTRIC

Subject: *Introducing a new, electric-powered, convertible wheel/float kit.*

Source: *Videoland™ Productions, 805C College St. S.E., Lacey, WA 98503; (206) 491-1332.*

Summary: *After a brief introduction to the differences between electric and gas construction, the model—resembling a Schneider cup monoplane racer of the '30s—is shown flying with authority from wheels and floats.*

List price: *$14.95 (plus $3 S&H).*

Rating: ✈ ✈ ✈ ✈ ✈

Approximate length: *21 minutes.*

This cleanly produced, unassuming tape is a pleasant convincer that electrics have "oomph." Basically an infomercial about Stream Inc.'s low-wing monoplane designed around the Astro 25 and 40 cobalt motors on 14 cells and up, the opening segment shows why an electric model can come out nearly as light as a gas model even though its powerplant and batteries are considerably heavier. I was delighted that the family cat, unscripted, felt it necessary to get into the picture. No hard sell here.

Most of the video shows the plane on wheels being flown from a frozen grass field and on floats from a glass-smooth pond on a windless day. In both cases, it gets off quickly and establishes an impressive rate of climb. The plane is flown through smooth elementary aerobatics, including very round loops from level flight. Shown with the sound off, you'd swear you were watching a gas-powered model.

I would have liked some more information on flight duration, aerobatic capabilities and on how the model handles on the water in a breeze (the old crosswind taxi problem). Nonetheless, the tape does its job. It's just the ticket if you're interested in powerful electrics or electric floatplanes or if you want to know something about the model.

The kit is made by Stream Inc., P.O. Box 113, Newport News, VA 23601; (804) 591-0720.

HOW IT'S MADE

Subject: *How the record-setting AR-5 was built, and an interesting section on its crash.*

Source: *The Arnold Co., 5960 S. Land Park Dr. #361, Sacramento, CA 95822.*

Summary: *Fast and clever composite construction techniques that don't need vacuum-bagging; shown on a full-size craft, but many of the ideas readily apply to models.*

List price: *$49.95.*

Rating: ✈ ✈ ✈ ✈ ✈

Approximate length: *115 minutes.*

This is a companion tape to the previously reviewed (and superb) "Why it Goes So Fast" video. (I did not watch or review it then because I thought it wouldn't be applicable to model building.) I have made bigger mistakes.

The tape shows many quick and effective techniques for making light, strong, thin-section parts. The method of attaching formers to fuselage shells is especially instructive. The method is very light and neat, and results in a join that will neither come apart nor concentrate stresses unduly.

A good portion of the tape is devoted to analyzing the crash (owing to the failure of a mechanical solder joint, but I won't give away more than that) of Arnold's record-setting AR-5. Neither pilot nor plane was seriously damaged. As Arnold says on the well-presented tape, "Nobody wants a crash, but they're fun to look at when they've come down hard." I found seeing what broke and what didn't, and why, to be instructive and applicable to model building.

Many design and construction techniques are demonstrated, and they're already influencing my own structural designing. They will probably inspire you as well. I recommend both tapes in the series. The set sells for $79.90.

R/C FLIGHT INSTRUCTION VIDEOTAPE SERIES, VOL. 1.1

Subject: *How to fly gas-powered R/C models for the beginner.*

Source: *Silicon Valley R/C Technologies; (800) 822-1500.*

Summary: *Contains some misinformation; has limited applicability; is poorly produced.*

List price: *Tapes 1- 4, $79.95 plus S&H; tapes 5 - 7, $59.95 plus S&H.*

Rating: ✈ ✈ ✈ ✈ ✈

Approximate length: *Tapes vary. Most are about an hour long; a few are shorter.*

This is an ambitious attempt to cover in a series of seven tapes every aspect of R/C flight for a beginner. Silicon Valley's technique is to use a high-wing trainer with dihedral so that the rudder rolls the plane rather than yawing it. The intention is to simplify the learning process by using only the rudder and throttle controls.

Unfortunately, the value of these videos as instructional material is marred by many careless errors and nonstandard terminology. Here are a few typical gaffes: we are told that the root of a wing is the tip and vice versa; a plane is said to be yawing but we actually see a spiral dive; we are told that a Ni-Cd starter battery runs at 1.5 volts (it's 1.2) and, unnecessarily, that "a fuel bulb does not require a power source"; they explain that a "symetrical" (their spelling) airfoil flies solely because of pressure build-up on the bottom; they call the stabilizer the "horizontal fin"; "angle of attack" is used where "angle of climb" is meant; you are advised to check control surfaces for centering but not for proper direction of movement; and they suggest you should use "ball joint" Allen wrenches. (They mean "ball end.")

Unsafe practices are demonstrated: running engines are worked on without proper eye or ear protection and with the operator in front of the model reaching across the propeller. Often, the tapes belabor the obvious and use stilted English:

(Continued on page 138)

(Continued from page 128)

reviewers? It's time to get with the program!

CONCLUSIONS

Thunder Tiger isn't the only manufacturer to make good use of highly specialized CNC machinery (right, Henry Nelson*?) for the production of model engines, but they certainly are producing an engine that should be well-received by the hobby/sport community. There's been an order of magnitude increase in the quality of their product; the performance proves it. As an aside, I wish I had the time to maximize this engine's performance; I'd bet there's 5.5b.hp per cubic inch hiding in there. That's 2.00b.hp, friends—out of a .36!

Hits

- A beautifully produced, lightweight, powerful, user-friendly engine.
- By far the best instructions I have ever seen. Thunder Tiger tells it all in four separate sheets, including a booklet. The descriptions are well-written with excellent pictorial drawings, exploded views, photographs, parts list, troubleshooting charts, specifications and carburetor-adjustment procedures. Much effort is expended concerning the safe operation of the engine for beginners and experts alike. They even describe and illustrate which accessories are needed to run the engine.

Other manufacturers should take note (especially certain European companies): how about supplementing your hardware with software like Thunder Tiger's? My suggestion: go out and buy a TT Magnum Pro and *copy* their instructions format; now, wouldn't that be a switch?!

Misses

- Poor technical instructions for the break in (obsolete).
- Wrong socket-head wrench included.
- Dangerous needle-valve location: too close to the prop for a small engine. How

(Continued on page 138)

RPM

(Continued from page 137)

about a remote needle-valve assembly off the rear housing?

One of the few screw-ups we had was back at the "RPM" workshop after the flying session. Frank was furiously trying to calculate the props' limiting speed with the calculator I had handed him, while I went back to carrying in the toolboxes. After about 30 seconds of looking for the display, Frank said, "What the heck, Dave! This calculator you gave me is the TV remote control! No wonder I can't figure this out!" We both had a good laugh and decided that it was time to relax with a good Canadian ale.

**Here are the addresses of the companies mentioned in this article:*
Thunder Tiger; *distributed by Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728.*
John Klotz, *P.O. Box 11343, Fort Wayne, IN 46857.*
Top Flite Models; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
Airtrax, L&R Aircraft Ltd., *13645 Fisher Rd., Burton, OH 44021.*
APC Props; *distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.*
Rev-Up; *distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.*
Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.*
Nelson Competition Engines, *121 Pebble Creek Ln., Zelienople, PA 16063.*
Zinger; *distributed J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.*
Webra; *distributed by Horizon Hobby Distributors, P.O. Box 3726, Champaign, IL 61826.*
K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, AZ 86403.*
Sheldon's Hobby Shop, *2135 Old Oakland Rd., San Jose, CA 95131.* ■

VIDEO VIEWS

(Continued from page 136)

"The observed direction of travel along a horizontal axis is given one of two names: 'left' or 'right.' The observed movement along a vertical axis is given one of two names: 'up' or 'down'."

Not everything about these tapes is incompetent, but there is so much erroneous, confusing and irrelevant material that, in my opinion, a beginner can't tell which is which. I regret that, in the face of so major an effort on the part of the tape's producers, I cannot recommend any tape in this series. ■

AIRWAVES

(Continued from page 9)

KNIGHT QUEST

I recently found a copy of an article about the "Knight Twister" from the September '85 issue of *Model Airplane News*. I became very interested in that plane and would like to build a model of it. The article said that a construction article (for a 1/3-scale model) would follow. Consequently, I wonder if these drawings

(Continued on page 145)

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the ***Model Airplane News*** **Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address and telephone number.

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[4/94]

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Fax: 55-031-4615501 **[9/94]**

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[6/94]

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251 Danbury Rd., Wilton, CT 06897.
For more information, call toll-free (800) 243-6685 and ask for Arlene Melko.

PRODUCT NEWS

MARK'S MODEL BUILDING
Sukhoi SU 26M

This ¼-scale Russian Sukhoi kit is constructed of balsa and plywood and is available custom-built (framed up) or completely finished. Specifications: wingspan—76 inches; wing area—836 square inches; ready-to-fly weight—8 to 9 pounds; suggested power—.90 2-stroke or 1.20 4-stroke.

Mark will custom-build any model airplane kits; call for price information.

Mark's Model Building, 133 Bayard St., Kane, PA 16735; (814) 837-9435.

USR&D CORPORATION
AERO*COMP Software—Version 2.0

Version 2.0 of AERO*COMP is now available. (See the November '92 review of the original version.) Its motor menu provides data for more than 100 commonly used electric motors of all sizes. Now you can program the number of blades, as well as the prop's diameter and pitch, into the prop menu. A separate battery menu controls cell capacity, voltage and impedance. In the aircraft menu, you can input airfoil type, fuselage type and landing-gear data. Version 2.0 has many additional outputs, including motor horsepower, average climb angle and maximum flight time in still air.

Prices—$79 (plus $3 S&H; NJ residents, add 6percent sales tax); $39 (upgrade to 2.0).

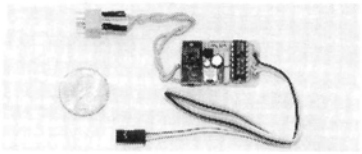
USR&D Corp., P.O. Box 753, Hackettstown, NJ 07840-0753; (908) 850-4131.

HITEC RCD
Prism

The Prism is a user-friendly, 7-channel FM computer radio. It has only two loops—one for setup and the other for adjustments. It features a PCM/PPM selectable mode, a compact LCD display and a three-model memory. The Prism's functions include EPA, dual rate, exponential, trim memory, trim rate, sub-trim, trim reset, snap roll, servo reverse and throttle ATV. Mixing options are channels 6-2, 1-7, 1-6, 1-2 and 2-4.

Part no.—HRS5000; **price**—$399.95.

Hitec RCD Inc., 10729 Wheatlands Ave., Ste. C, Santee, CA 92071; (619) 258-4940.

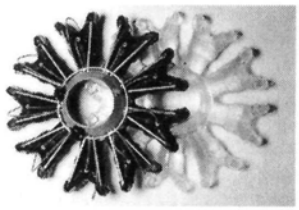


DICKYBIRD MODELS
DB120 Electric Motor-Control Unit

Designed to complement the DB122 50W motor and the DB123 4x800mAh flight battery pack, this motor-control unit automatically shuts the motor off when the battery reaches 3 volts to ensure sufficient reserve battery power to continue radio-servo control. The DB121 battery eliminator-circuit wiring harness runs off receiver voltage directly from the flight battery, independent of motor voltage. DB120 specifications: dimensions—1.6x0.9x0.5 inches; weight—¾ ounce. DB121 specifications: weight—½ ounce.

Part nos.—DB120; DB121; DB122; DB123; **prices**—$24.95; $9.95; $15.95; $15.95.

Dickybird Models, P.O. Box 1249, Westminster, CA 92684-1249; (714) 775-4153.

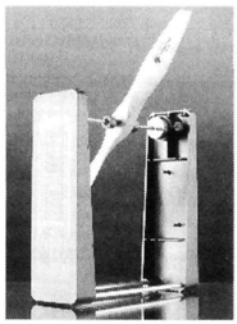


FRANK TIANO ENTERPRISES
Dummy Radial Engines

FTE offers 9-cylinder, cast-resin, dummy radial engines. They are available in ¼, ⅕, 1/6 and ⅛ scales and are intended for cowled applications only, because only the front half is duplicated. Each comes with easy instructions for mounting and reinforcing the casting with lite-ply.

Prices—$22 (⅛ scale); $26 (⅕ or 1/6 scale); $32 (¼ scale).

Frank Tiano Enterprises, 15300 Estancia Ln., West Palm Beach, FL 33414; (407) 795-6600.



GREAT PLANES
Top Flite Prop Balancer

Constructed of long-lasting, high-impact plastic and nickel-plated steel, this precision magnetic balancer can be assembled in seconds, and you can easily disassemble it for convenient flight-box storage. It will balance ducted-fan rotors, airplane propellers up to 24 inches long and more. Its unique "floating" shaft design (patent pending) virtually eliminates friction for maximum sensitivity. The steel balancing shaft, which is suspended between powerful, Ceramic-8 magnets, will support and accurately balance objects weighing up to approximately 5.5 ounces!

Part no.—TOPQ5700; **price**—$26.99.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

PRODUCT NEWS

ACE R/C
Whiz 40

Ace R/C has released the standard Whiz 40 kit at a significant price reduction. It doesn't contain the wheels, the tank, the motor mount, or the "Getting Started" book, but it isn't a stripped-down version, either. It comes with a complete hardware package, which includes the linkages that aren't found in most other kits, and top-quality materials that you build into a sturdy, high-winged sport flier. Specifications: wingspan—70 inches; wing area—840 square inches; weight—6.75 pounds.; length—53½ inches; engine—.25 to .45 2-stroke; .40 to .60 4-stroke; radio—4-channel.

Part nos.—50K235 (Whiz 40 kit); 50K235STD (Whiz 40 standard kit).

Prices—$109.95; $89.95.

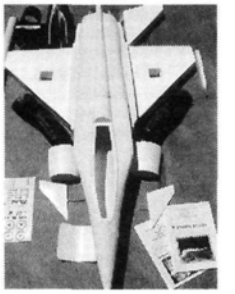
Ace R/C, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037-0472; (816) 584-7121.

CUSTOM ELECTRONICS
Universal Radio Adapters

These adapters are ideal for mixing and matching your servos and receivers. Five adapters are available for use with Futaba "G", Ace/Deans, Hitec/JR, Futaba "J", or Airtronics receivers. One end of the adapter has a universal connector that will mate with Airtronics, Futaba "J", JR, Hitec and World Engines servos or receiver batteries.

Price—$5 each.

Custom Electronics, R.R. 1, Box 123 B, Higginsville, MO 64037; (816) 584-6284.



AEROLOFT DESIGNS
Rafale A

This sport-scale, ducted-fan jet kit can be built with fully functioning canards, or they can be "locked out" so that only the elevons are used for flying. The basic kit contains a gelcoated epoxy/glass fuselage, intakes, a thrust tube, canards, splitter plates, a drop-in hatch, rocket rails, exhaust cones, a clear canopy, a vacuum-formed cockpit interior, foam wings and stab and pressure-sensitive decals. The deluxe kit contains the basic kit components and the wood and hardware.

Prices—$695 (basic); $840 (deluxe).

Aeroloft Designs, 2940 W. Gregg Dr., Chandler, AZ 85224; (602) 838-0447.

PACIFIC NORTHWEST INDUSTRIES
Transmitter Tray

This all-aluminum transmitter tray has adjustable, foam-padded shoulder straps that provide the stability you need when flying. The shoulder straps are held firmly in place by spring tension and a locking wedge. The straps can be removed from the transmitter and tray for easy transportation and storage. The tray has removable, adjustable palm rests that can be positioned to match your transmitter. You can quickly adjust the tray using nylon wing nuts. It comes with a money-back guarantee.

Price—$89.95.

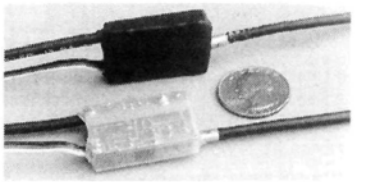
Pacific Northwest Industries, 9658 Ronald Dr., Blaine, WA 98230; (206) 332-8822.

IKON N'WST
Fairchild 22

This ¼-scale kit can be assembled quickly and easily. It features hand-cut parts, a pre-bent landing gear, a fiberglass cowl, wheel pants, inked drawings, a full set of decals and a complete hardware kit. The fuselage is strong enough for most engines. The three-piece wings are mounted on tubes and struts. The bent cabane supports slide into slots, and this makes construction easy. Specifications: weight—17 pounds; wingspan—98.5 inches.

Price—$260 (plus $9.50 S&H).

Ikon N'wst, P.O. Box 306, Post Falls, ID 83854.



ASTROFLIGHT
Micro-Series Speed Controllers

Designed for small electric airplanes that are powered by .01 to .05 motors, the model 217 micro speed controller can handle up to 25A loads and one to 14 cells. The 15-gram, 1.25x0.9x0.25-inch-thick controller is a forward-only version that features extremely efficient low-loss transistors and 14-gauge power wires.

Price—$49.95.

AstroFlight Inc., 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.

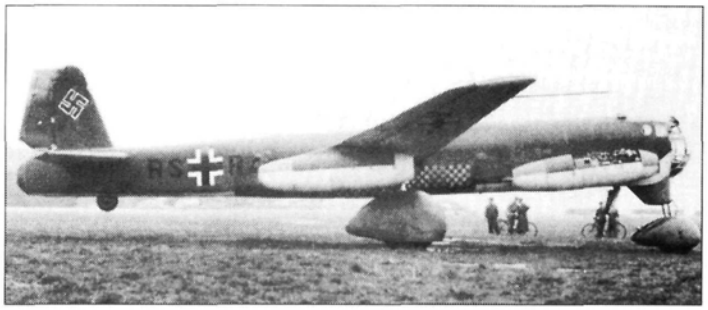
Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

Manufacturers! To have your products featured here, address the press releases to **Model Airplane News,** attention: Julie Soriano.

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.



CONGRATULATIONS to Troy Benham of Preston, CT, for correctly identifying the November '93 mystery plane. Built by the Sargent-Fletcher Co. of El Monte, CA, the Fletcher FU-24 first flew in July '54. The FU-24 "Utility" was designed to carry a pilot and four passengers, or 1,000 pounds of cargo, such as crop-dusting equipment. The 31-foot-long plane was designed for transporting work crews, fighting fires and search-and-rescue work. It had a 42-foot, 10-inch wingspan, was 9 feet, 4 inches high and weighed 2,620 pounds. Powered by a 240hp Continental O-470-N engine, the Utility's range (with a maximum payload of 2,320 pounds) was 410 miles. It could cruise at 110mph at 75 percent power, and it had a maximum speed of 141mph. Its service ceiling was 14,700 feet, and its absolute ceiling, 17,000 feet. The plane could also be powered by a 400hp Lycoming IO-720-A1A engine. By 1978, approximately 255 of these planes had been manufactured. ■

PHOTO COURTESY OF SCALE MODEL RESEARCH

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLUB OF THE MONTH

BAY FLYERS MODEL CLUB

P.O. BOX 278,
MAPLEWOOD, WI 54226-0278

CONGRATULATIONS TO the Bay Flyers Model Club for being this month's winner! We received dozens of November newsletters informing members that it's time for the election of officers and the payment of dues, but this issue of *The Bay Peninsula Flyer* was a little different. The club is not only busy with elections and dues, but it's also sponsoring a two-session 4H Super Saturday program called "Fun With Model Airplanes." Several club members will assist club secretary Larry Huber and president Ron Marto to build AMA Cub and Dart kits with 12 youngsters—a great way to promote the sport. When the models are completed, they'll be flown at a local flying field.

The club is also arranging a few unusual events, such as a Frozen Finger Fun Fly event in February, and their annual Spring Dumb Thumb Clinic in early May. There is also talk about planning a cross-country flight with an R/C model; please keep us posted!

The club's informative newsletter also contains, "Letters to the Editor," "Airport Activities," "Glider Flying Activities," a "Buy-Sell-Swap" page and calendars that list club events for the next two months.

We loved the ending of *The Bay Peninsula Flyer*; it states "The object of this newsletter is to provide information...to encourage safe practices in building and flying and to encourage good sportsmanship." These are some of the criteria we look for in choosing our "Club of the Month." So, to the Bay Flyers Model Club: we hope that you'll enjoy two subscriptions to *Model Airplane News!* ■

(Continued from page 138)

are still available and, if so, how I can obtain a set?

ODD BRISING
Gothenburg, Sweden

Odd, the Knight Twister Imperial was published in two parts in the September and October '85 issues of "Model Airplane News." The part you mention dealt with the full-size aircraft and its design history. Part 2 was the construction article for the 1/3-scale model designed by Dan Santich. The model has a 70-inch top wingspan, a 62-inch bottom wingspan and a total wing area of 1,505 square inches. The model was originally powered by a Super Tartan Twin, and Dan subsequently used a Saito FA 270, an O.S. 240 Gemini Twin and a Horner twin inside the cowl. One very interesting feature of the model is that Dan chose to use Bob Violett Model's Magnalite material instead of the usual plywood for all the formers, doublers, interplane struts, wingtip bows and tail surfaces. Along with careful planning and designing, this material produced a light, 9-pound ready-to-fly model (minus fuel). To order the plans and to get information on shipping them to Sweden, call (203) 834-2330 (outside the USA). GY

WONDERFUL WITTMAN

Many years ago, I scratch-built a model of a Wittman Tailwind, but I don't remember where I got the plans from. Could they have come from *Model Airplane News*, and if so, how can I obtain another copy?

BILL MEACHAM
Woodland Hills, CA

Bill, sometime in 1982, Air Age Inc. published "Giant Steps"—a book that was filled with information on giant-size models. It contained many construction
(Continued on page 146)

AIRWAVES

(Continued from page 145)

articles for biggies, and one of them was a Wittman Tailwind W-10 that was designed and built by Hal "Pappy" deBolt. The 1/3-scale model had a 96-inch wingspan, was powered by a Quadra engine and used traditional wood construction. If this sounds like the one that you built, the plans are still available (no. FSP00004). You can order them by calling (800) 243-6685. GY

KEEP THIS IN MIND

I'd like to compliment you on the excellence of your magazine and address an important issue that can't be overstressed: *safety!*

Recently, I bench-tested a new .65 sport engine swinging a 12x8 composite propeller. While I was making adjustments to the fuel flow—the propeller was turning at about 7,000rpm—my right hand slipped and entered the arc of the propeller. One of my fingers and my thumb sustained minor damage, but my index finger was severely damaged. After six to eight weeks of recuperation, there will be a question as to how much use I'll regain of that finger.

I wrote to you about this so that the readers would remember that just because it's small, that doesn't mean it's not dangerous! All you have to do is ask me; I nearly lost a finger. So, fly safely!

T.W. ABRAMS
Nome, AL

Thank you for sharing the details of your mishap with us, Mr. Abrams. We hope your graphic account will imprint on some, and serve to thwart similar dangerous circumstances that often end in injury. CC

PUP PARTICULARS

I'm in the process of gathering info to build a Balsa USA Sopwith Pup in 1/3 scale. I noticed that Mr. Bud Roane of Melbourne, FL, placed 22nd in the Top Gun Invitational with a Pup, and I thought I might contact him for documentation sources. I've tried to contact him by phone but have been unsuccessful. Could you possibly supply me with his address and/or phone number, or other sources of Pup documentation? I'm interested in the technical side of R/C and really appreciate the tech info and references to manufacturers at the end of articles in *Model Airplane News.*

EMILE ALLINE
Lynnwood, WA

Emile, unfortunately, we don't have Mr Roane's address for you. To protect thei privacy, we don't supply the addresses o the phone numbers of authors an personalities appearing in "Mode Airplane News." The best way to contac an author or another person in th magazine is to send us a letter and a SASE so that we can forward it to th person in question. With regard to th pilots and the information involved in To Gun, you should direct your questions t Frank Tiano, c/o "Model Airplane News," 251 Danbury Rd., Wilton CT 06897.

An excellent place to start looking fo documentation for the Sopwith Pup—o any other aircraft—is Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. Bob's catalogue "Scale Aircraft Documentation and Resource Guide" includes 22,000 three-views and 5,000 color photo packages. Bob has added 800 new packages just this year. Articles dealing with scale modeling and the addresses of many scale model aircraft companies are also included. The current price for catalogue no. 11 is $6 (U.S.) and $7 (Canada). Tell 'em "Model Airplanes News" sent ya. GY